Fortress



The Vauban Fortifications of France

Paddy Griffith • Illustrated by Peter Dennis



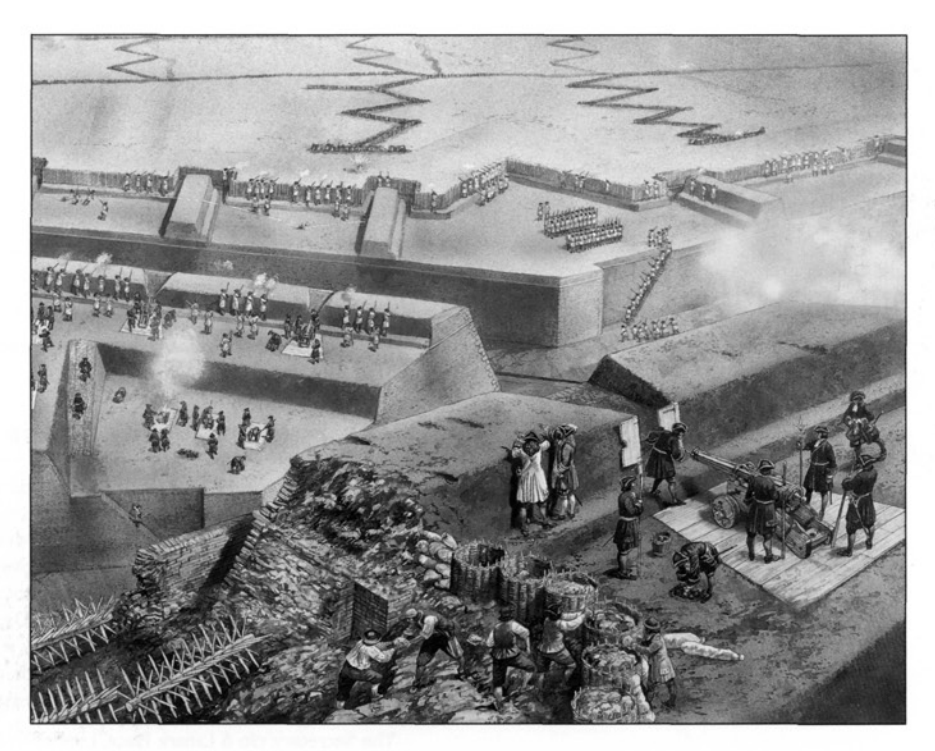
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Pour ma belle-soeur, Marguerite Mouriaux.

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Artist's note

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The Fortress Study Group (FSG)

The object of the FSG is to advance the education of the public in the study of all aspects of fortifications and their armaments, especially works constructed to mount or resist artillery. The FSG holds an annual conference in September over a long weekend with visits and evening lectures, an annual tour abroad lasting about eight days, and an annual Members' Day.
The FSG journal *FORT* is published annually, and its newsletter *Casemate* is published three times a year. Membership is international. For further details, please contact:

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Contents

Vauban: an indefatigable servant of the king

During the 77-year life of Louis XIV, France was at peace for only 17 years – less than one year in four. The rest of the time was taken up in warfare against most of the other states of Europe, as the 'Sun King' pushed forward his frontiers and tested the extent to which he could exploit France's central position, her modern bureaucracy, and her large and industrious population.

To help him in these wars, Louis XIV was able to call upon a highly gifted group of field commanders such as Turenne, Condé, and Luxembourg. Between them, they did much to advance the general European 'Art of War', including some brilliant mobile operations which helped to set the military agenda for the whole of the 18th century, and even beyond. However the military predominance of France among the states of Europe ultimately owed more to the equally gifted group of administrators, most notably Colbert and Louvois, who worked at the centre to organize the state's infrastructure for war, in both financial and logistical terms. It was they who provided the money from a modernized tax structure, and then made sure it was properly spent on all the regiments, ships, guns, stockpiles of powder, and rations – and also the fortresses – that a great power would insatiably require when it set out to occupy and defend what it saw as its geographically 'natural' frontiers.

Somewhere halfway between the field commanders and the administrators stood the particularly impressive figure of Marshal Sebastien Le Prestre de Vauban (1633–1707). Born into the margins of the lesser Burgundian nobility, he rose to prominence as an engineer during the campaigns of the 1650s. Then he was set to work making reconnaissances of the defences of northern and eastern France as well as Germany and the Netherlands, until the War of Devolution (1667–68) when he was allowed to take a lead in planning the sieges and fortress building on the Belgian frontier, although he was normally excluded from the inner circle of strategic decision making. After that he participated fully in all of France's wars, and in the course of his career he was wounded eight times. He even commanded French troops in one field action, which was at Camaret near Brest in 1693, when his 'Troupes de Marine' shot down and repulsed an attempted British landing, taking 1,000 prisoners. Vauban's main occupation, however, was essentially to oversee and improve all French fortifications until 1704, when he was cruelly snubbed and ignored by an ignorant new generation of ministers. He died in 1707, leaving many unpublished works, political tracts, topographical surveys, novel thoughts on fortification, and at least two major manuals of siegecraft. Many of these writings were collected in his last years as his '*Oisivétés*' (or 'Idle thoughts'), which when taken together amount to a far-reaching monument to his life's work, and a remarkable overview of many varied aspects of France under the 'Sun King'.[1]

Along the way Vauban had also dabbled in civil engineering, helping to design the grandiose but financially doomed Maintenon Aqueduct to supply Versailles with water (1684–85); Riquet's great Canal du Midi (or Canal des Deux Mers) which linked the Mediterranean to the Atlantic, as well as planning many harbours and re-planning many town centres. Vauban is further credited (1689) with the invention of the bayonet – a simple device which, because it expelled the cumbersome pike from the military inventory, may be said to have revolutionized general warfare no less importantly than his more numerous innovations in the defence of, and especially the attack on fortresses.

[1] His writings are extensively discussed in Virol, *Vauban.*

Before Vauban the art of siege had been a haphazard and often very costly affair, with too many of the attacking troops concentrated into too narrow an axis of advance, and too many reckless frontal assaults before the defenders could be fully subdued. Once Vauban had been able to introduce his new and more scientific methods, by contrast, the attacking troops would be much less exposed to enemy fire, and would themselves be able to develop more telling firepower upon the points selected for attack. Vauban's sieges were conducted using a system of parallels on a broad front, combined with careful sapping forward and the application of enfilading ricochet fire to sweep the enemy's ramparts. The attackers would take few losses as they pushed their sap heads inexorably forward, through the defender's outworks and onto the counterscarp of his main ditch. Breaching batteries would be established there and the main wall would be pounded until it crumbled, leaving an open pathway into the heart of the besieged fortress. At this point a prudent fortress governor would normally wish to surrender the place, before the horrors of a storming overtook him; but even if he did not, the end would not be long delayed. In fact Vauban took pride in his ability to predict the exact time each siege would take him, even before the operation had started, based upon his calculations of just how long each phase of 'the march of the siege' would take. All this represented something of a revolution in the art of war as a whole, since it made sieges both predictable and short, whereas previously they had too often been the exact opposite.

Sieges were prestigious events, ideally lasting only a week or two, and ending in a clear victory to the royal armies when the fortress was captured. Twenty of Vauban's 53 sieges were attended by the king himself, to lend his own glory to the event – and also to reward Vauban with handsome purses for his expertise. In fact the capture of an important fortress like Mons (£100,000) or Namur (£120,000) could regularly win him up to ten times the money that he might earn from a whole year's work on the Canal du Midi (£12,000).[2] His sieges also brought Vauban the promotions which would eventually, in 1703, make him a marshal. This final acknowledgement admittedly came very late in the day, after half a century of service, since although it was far more prestigious and glorious to capture fortresses than to build them, the arts of the engineer were still generally held to be less glamorous than those of a commander in the field, many of whom were notorious dunces in siegecraft. The case of the Duc de la Feuillade at Turin in 1706 is symptomatic. Vauban, who had helped design the Turin defences, clearly told the duke to attack the town rather than the citadel, and to progress systematically and carefully. But de Feuillade, who had been a marshal since as long ago as 1675, thought he knew better, and after a series of bloody frontal assaults on the citadel was forced to raise the siege and retreat in ignominious circumstances.

Out of all his many achievements Vauban's technical innovations in siegecraft made a far bigger difference to the way wars were fought than did any of his fortress-building; or in qualitative terms he helped the offensive considerably more than the defensive. In terms of quantity, however, it must surely remain axiomatic that the sheer scale of his fortress-building surpassed the performance of any other officer known to military history, with the possible exceptions of Albert Speer, who was in charge of Hitler's fortifications, and the Emperor Ch'in Shih Huang Ti, who built the Great Wall of China.

Estimates vary wildly over just how many fortresses Vauban designed, with Professor Christopher Duffy[3] putting the figure at around 60, Sir Reginald Blomfield putting it nearer 101,[4] no less an authority than Voltaire putting it firmly at 150,[5] and Christopher Duffy (again!) claiming 160.[6] One modern

[2] Virol, p.72.
[3] *Fire & Stone*, p.11.
[4] *Sebastien le Prestre de Vauban*, p.206.
[5] Ibid.
[6] *Siege Warfare*, Vol. 2, p.71.

RIGHT **Vauban directing the rebuilding of the captured fortress of Bergues**

Vauban (in the red coat) is shown here standing on a tower of the medieval walls of Bergues, briefing a couple of junior engineer officers on the rebuilding. In the background, workers are executing the construction of a ravelin according to his plan using spades, picks and mattocks. The ditches and a *cuvette* are in the process of being excavated, and note the cross-section through the rampart in the centre-right showing the materials used.



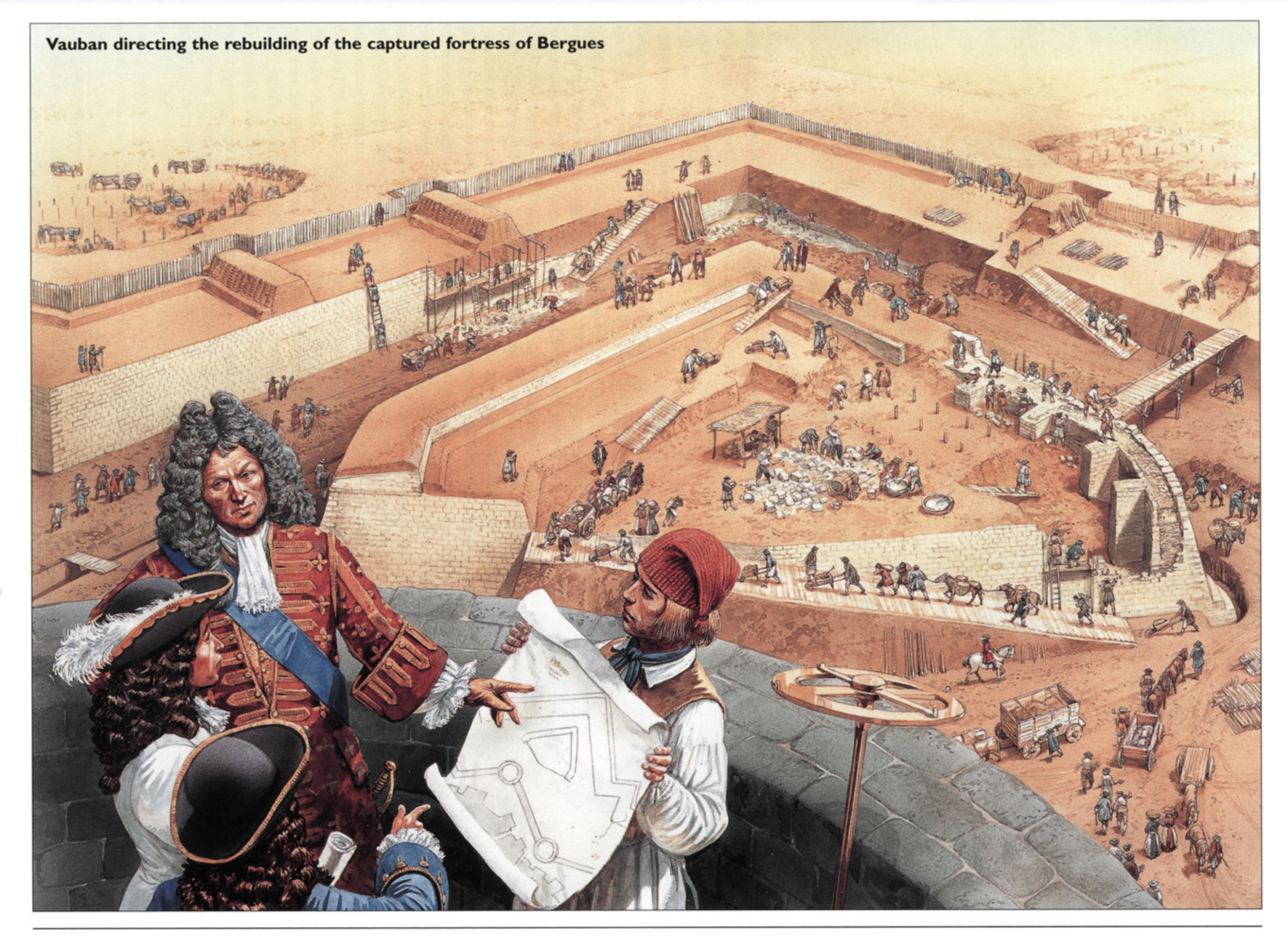
ABOVE The angle of a sandstone bastion at Strasbourg with its flanking bastion in the distance, and a recently landscaped wet ditch to its front. In 1681 the French occupied the city and its *enceinte*, which had 16 bastions, after which Vauban and Tarade added a bastioned citadel and extensive new water features. (Viv Haywood)



ABOVE RIGHT Fort National, on a small islet just east of St Malo city centre. This is one of an extensive cluster of small 17th-century forts protecting this strategic harbour, in a manner highly reminiscent of the rings of outlying forts that would became standard for most fortresses (due to the ever-increasing range of rifled artillery) during the late 19th century. (Paddy Griffith)



RIGHT The successful French siege of St Omer, 1677, which would deliver an important addition to Vauban's *Pré Carré*. The artist seems to have an accurate understanding of the lavish scale of artillery fire required for effective siegework against elaborate modern fortifications. (Documents at the Musée des Plans Reliefs)



Vauban directing the rebuilding of the captured fortress of Bergues

RIGHT A view of the south-east corner of the city walls at St Malo, illustrating the way that Vauban often had to blend a modern angular bastioned trace (to right of picture) with a medieval trace based on round towers (to left of picture). (Paddy Griffith)



author claims the total was no less than 300,[7] with another ramping it up to 308[8] and another yet again even claiming an incredible 330.[9] Obviously a great deal depends on exactly how one counts these things; but to the present author the correct total seems to be nearer 160 than any other figure (see Table I on page 13).

There are admittedly considerable differences between the number of complete new fortress towns that Vauban built from scratch (normally quoted as eight or nine, although Wenzler goes up to 30), the number of improvements to existing fortresses that he personally helped to carry to completion, and the number of ideas for future work that he laid out for others to build, or not, as the case might be. We can at least see that Vauban must have designed a major defensive project on average about once every three or four months throughout his long working life. He also made constant tours of inspection in which he would not only supervise work in progress, but would try to detect weaknesses in the national defences and issue a stream of new sketches and designs to eliminate them. In some years he would inspect the fortification of frontiers as far apart as Belgium, the Pyrenees, and Brittany, and still find the energy to cover the Rhine, the Alps, and the Biscay coast in the following year. In the 20 years between 1678 and 1698 he clocked up an average of around 3,500 km per year. He normally did his travelling in around 100 days in each year, although in 1681 he hit a record 7,500 km in 250 days.[10] During most of the 50 years in which he was active he appeared indefatigable, and his attention to detail was legendary. At Besançon, for example, he made no fewer than 17 visits to watch over the progress of the building work.

[7] Wenzler, *Architecture du bastion*, p.10.
[8] P J-F Pernot in Renson, Daniel, ed., 'Vauban, Ingénieur du Roi-Soleil', p.8.
[9] Haettel, *Vauban aux frontières de l'Est*, p.17.
[10] Virol, p.11, following Blanchard.

The limits of Vauban's achievement

Admittedly there are a number of major fortresses in which Vauban is not recorded as having played any role apart, presumably, from taking a look and approving what he saw. Amiens (Somme), St Quentin (Aisne), and Haguenau (Bas Rhin) spring to mind. Many of his inspections led to no further action; for example, he visited 22 Dutch places in 1672, but made few improvements to them. Equally, many of Vauban's designs were merely 'projects' that were put into effect only many years later (e.g. his plans for Metz were completed only in 1752, and those for both Toul and Verdun only around 1850). Sometimes they were executed in an altered form (e.g. many of the works finished in the mid-18th century were supervised by the engineer Cormontaigne, who had his own ideas), or never at all (e.g. the 'green field sites' of Mouzon and Stenay on the Meuse, or the projected extension to Sisteron in the Alps). Even the spendthrift Louis XIV did sometimes decide to withhold funds from certain projects, and of course his perceived strategic priorities were constantly shifting and changing. In the case of Cherbourg, work had already started on Vauban's plans in 1686–87 when Louvois personally countermanded them and the buildings were demolished in 1688–89. Vauban returned to the case in 1692, after Louvois had died; but his designs remained largely on the shelf until fresh impetus was given by a British naval raid in 1758. Despite the vast scope of his influence, therefore, we cannot say that Vauban would always automatically get his way, not even after he had finally achieved the rank of Marshal of France. In fact the last few years of his life were marked by a sharp decline in his influence at court, doubtless proportionate to his growing interest in social reform and equitable taxation – which from the perspective of Versailles amounted to something very close to 'political subversion'.

In his later life Vauban would also find that more than a few of his fortresses, especially those sited outside French frontiers, had to be demolished for reasons of state. This might be imposed by the terms of some treaty, or simply because the French were unilaterally withdrawing from advanced positions, and did not want to leave behind a stronghold that they might later have to recapture. Indeed, as early as 1675 Vauban had recognized that because the national chain of fortifications had to be planned centrally, this implied that some existing fortifications might be surplus to requirements and should be demolished to save money. It was a theme to which he would return in 1694, 1696, and again in his *Oisivétés*. We should remember that in this era France was still emerging from a late medieval world in which most towns and even many stately homes had been fortified to some degree, so it was sometimes difficult to distinguish between the 'serious' fortresses and those that were strategically unnecessary but were maintained on the official list of state-sponsored defensive works merely out of inertia. Even when that inertia had been overcome and a particular fortification was de-listed, it might well continue to be maintained and manned in an unofficial manner by town militias or other non-regular forces.

The list of Vauban's fortifications may be further diluted by the input of other engineers who took a hand in construction. In many cases a particular project was initially designed by Vauban but actually built by someone else and, in the case of the engineer Niquet, often with lively and even acrimonious disagreements between the two. Vauban was far from the only French fortress builder active in his era, and with the king's support he did sometimes have to assert his authority over his rivals: most notably his immediate superior, le



RIGHT The 1580 Fort Carré at Antibes, which Vauban would later strengthen together with the main town across the bay that it protected (not shown). Note the acute-angled bastions with narrow gorges, and the almost non-existent counterscarp defences: both of which were outdated features that Vauban would strive to abolish. (Christian Carlet at the Musée des Plans Reliefs)



RIGHT Vauban's grandiose design for a fortified harbour (or *bassin*) at Ambleteuse (between Boulogne and Calais), including sluices, pentagonal citadel, town *enceinte* and fortified jetties covering the port entrance. Only the small semi-circular fort facing the sea (in the centre of the map) was ever built, although the harbour remained in use well into the 19th century. (Documents at the Musée des Plans Reliefs)

Chevalier de Clerville, Commissaire Général des Fortifications, who died an embittered man in 1677, thereby allowing Vauban to accede to the office in the following year. Other contemporary French collaborators included Lapara de Fieux ('the Vauban of the Mediterranean coast'), Simon de Garagan, the Vicomte d'Aspremont, Jacques de Tarade, and half a dozen more, with whom Vauban appears to have managed to maintain amicable relations.

Then again, Vauban's reputation stands so high that over the years many fortifications have been attributed to him in which he may have had no hand at all. It is perhaps perfectly acceptable in a case like Fort Louis, which he and the engineer Tarade built together from scratch from 1686 onwards. When it had to be de-royalized hastily for political reasons during the French Revolution it was re-named 'Fort Vauban', although that did admittedly rather slight the contribution of Tarade, who had shared the work. By contrast the case of the Pointe de Merville coast defence battery in Normandy is entirely misleading, since it is today known as the 'Vauban' redoubt, suggesting that he designed it,



LEFT Vauban's Fort de l'Ambleteuse, seen from the landward side. Towards the land there are mainly musketry loopholes in light brick walls, supported by a couple of casemates for cannon. Towards the sea, however (not shown) there is a very powerful semi-circular artillery battery. (Paddy Griffith)



LEFT Fort Ambleteuse at high tide, seen from the north. Note the semi-circular battery for heavy guns, facing the sea (to the right of the picture), which was the basic purpose of the fortification. (Paddy Griffith)



LEFT The original 'Merville battery', designed in the 1770s to protect the mouth of the River Orne in Normandy. It has absolutely nothing to do with Vauban, even though it carries his name and reputation among local people. The passage of time has heaped up the sand dunes all around it, so that today it is not only very difficult to locate on the ground, but also it commands a field of fire of little more than ten metres in any given direction. (Paddy Griffith)

whereas in fact it was conceived and built only some 75 years after his death. (Note that this battery has nothing to do with the many German works of World War II vintage in the area.) This does not prevent a proliferation of local streets, cafés, and other civic amenities being named after the great man. One is strongly reminded of the proliferation of mythic sites in Britain at which King Arthur, or Robin Hood, or even a more recent figure like Queen Elizabeth I, are said to have put in an appearance, when there is no real evidence to support the claims. Such associations indicate a degree of wishful thinking in the local folk memory, and the modern historian must proceed with very great caution.

The *Pré Carré*

Despite such caveats, however, it remains true that Vauban did design an amazingly large number of fortifications which, when taken together, provided a unitary strategic framework for the defence of Louis XIV's newly defined France. From 1673 Vauban famously referred to this territory as a *Pré Carée*, which is literally a 'square meadow', although perhaps 'ring fenced estate' would be a better translation, in which his own personal role was to build the fences. Implicit in this central idea was the need to eliminate foreign fortresses from inside the king's consolidated lands; for example, the dukes of Lorraine and Savoy each held enclaves on the 'French' side of the Rhine and the Alps respectively. However, in Vauban's mind there was also an implication that the French should not stray beyond their own fences to attack their neighbours, and he disapproved strongly of some of Louis XIV's more aggressive adventures, particularly on the 'wrong' side of the Alps. Over a long period Vauban was quite a harsh critic of his king's expansionist instincts, which was a point that the king could not fail to notice.

We must remember that the *Pré Carré* represented an innovative way of thinking at a time when any given fortification had quite recently been seen as only a very localized matter, which might fit into a scheme of provincial defence at best, but not a truly national one. The whole idea of a centralized French state was itself relatively new in the 17th century, and the definition of its borders as running along the 'natural frontiers' of the Channel, the Bay of Biscay, the Pyrenees, the Mediterranean coast, the Alps and the Rhine was newer still. Vauban was nevertheless the man who provided a solid defensive skeleton to this otherwise ethereal dream of diplomats and kings, even though he was never entirely able to expel all foreign presences from inside the France of today (Savoy, Lorraine, and Mulhouse remained stubbornly independent until after his time) nor, conversely, was he able to sustain some of the more advanced fortresses that he had planted outside the *Pré Carré*, in the territory of what is today Belgium, Luxembourg, Germany, Italy, and Spain. Landau, for example, was one of his finest and most elaborate works, but it was located just too far north of the frontier with Germany to be tenable in the long term.

Although his key phrase referred to a 'square' (*carrée*) of national territory, Vauban probably did more than any other individual to define the frontiers of modern France as a 'hexagon' with its six points at (or near) Dunkirk, Strasbourg, Nice, Perpignan, Bayonne, and Brest. Vauban helped to fortify all six of these towns, and very many other places in between, as well as numerous back-stops as a 'second line' behind the frontiers. It was intrinsic to his concept of rationalizing the frontier defences, especially those facing the Netherlands, that there should be at least two clearly defined 'barrier' lines of fortresses. Each of the two lines from the Channel to the Meuse should consist of 13 places, after which both lines should be carried on further eastwards to the Rhine. It was Vauban's boast that every single spot in the barrier zone between Switzerland and the North Sea should be within earshot of the cannon of a French garrison, which is a concept highly reminiscent of the Western Front in 1914–18. Nor was this merely a light-hearted conceit, since the density and solidity of the double barrier was severely tested both in 1708–12, following the battle of Oudenarde and the fall of Lille, and again in 1793–94, when the chaotic state of the revolutionary armies seemed to leave the road to Paris open once more. In neither case were the enemies of France able to make significant progress through the frontier barrier, but became bogged down within it instead.

In memoirs written in 1685–86 and 1689, Vauban even foresaw the need to build a second *enceinte* around the capital city, Paris. The idea was to bring Paris up to the same technical standard of defence as the strongest outposts of the frontier zone, thereby making it a 'long stop' in national defence rather than leaving it as an open city. In an age of notoriously 'limited' border wars this represented a very advanced brand of thinking, which would not become popular until over a century later, following the Napoleonic experience of wars of deep invasion. In fact Paris would be properly fortified only in 1840.

The distribution of Vauban's 160 defensive projects is interesting, in that 36 per cent, or more than a third, were located on or beyond the northern frontier, facing the Low Countries. This may be explained by that region's relative lack of natural defensive barriers, and by its closeness to the sensitive spot of Paris. By contrast the north-eastern frontier was further away from the capital, and was strengthened by the Rhine river and the Vosges mountains; but it was an area in which Louis XIV was pushing forward particularly aggressively. Some 24 per cent of Vauban's projects were therefore sited in this direction. Overall this meant that a grand total of 60 per cent of his work was dedicated to the defence of the north and north-east, which represented little more than 25 per cent of France's total perimeter. However it is probably true that at least 60 per cent of the troops deployed by France's enemies were likely to attack across this particular section of the frontier.

In the case of the remaining frontiers, the enemy was likely to be less concentrated and more frustrated by the terrain. Even so, it is perhaps surprising to find that Vauban gave some 18 per cent of his efforts to the Alpine and Mediterranean defences, but only about 8 per cent to the Pyrenees, which did not present a significantly shorter frontage. This discrepancy may possibly be explained by the fact that although the Alps were higher than the Pyrenees, they were criss-crossed by more roads that had to be blocked, whereas the conventional lines of attack in the Pyrenees were limited to just the two extremities of the chain. Finally, it should be noted that the west coast, which was over twice as long as either the Alps or Pyrenees, received some 14 per cent of Vauban's attention. Admittedly the maritime nature of the threat meant that some of the fortifications could be relatively simple affairs; but this should not blind us to the impressive scale of the effort.

Table I: Vauban's fortress designs

This list of 160 cases was compiled from all the works consulted, although clearly these sparse notes would benefit from much further research into the details of each individual case. It is regretted that it has proved impossible to report on the current state of these fortifications.

* / ** / *** Fortifications represented by a *plan relief* are marked with one asterisk if the model is in the Hôtel des Invalides, Paris; or two asterisks if the model is in the Musée des Beaux Arts, Lille. The two fortifications with three asterisks can boast two *plan reliefs* each, since the originals were captured by the Prussians in 1815, then given back to the towns that they represent by Wilhelm II before World War I, meanwhile a 'replacement' was built in Paris after 1815, where it still resides.

Abbreviations: Fr. = France or French; Sp. = Spain or Spanish; V. = Vauban.

Name	Location (No. of French *département*, or country)	Notes
1. Northern Frontier (58 cases, or 36 per cent of the total)		
Aire sur la Lys**	62	V. captured it 1676 then built bastioned wall with two hornworks and inundations, 1680–85.

ABOVE Map of the double barrier of fortresses in the *Pré Carré* on the north-east border of France.



RIGHT The French 'hexagon'.

Fort de l'Ambleteuse	62; at mouth of river Selaque, or 'Slack', between Calais and Boulogne	V. built a semi–circular fort (20 guns with *fausse–braye*) and tower, but had planned a much bigger site that was not built, 1684–90.
Antwerp*	Belgium	V. inspected it and Liers 1702. (The *plan-relief* shows the siege of 1832.)
Arras	62	Obtained by Fr. 1668. Citadel fortified by d'Aspremont following V.'s plans, 1670.
Ath**	Hainault, Belgium	Captured and V. fortified it from scratch 1666–67 (octagonal bastioned wall), lost then recaptured 1697. Demolished by Joseph II, 1784.
Avesnes**	59	French until 1656, then again 1659. V. rebuilt and extended it 1661.
Bapaume	62	V. improved it.
Bergues**	59	Ex-Sp. fort renovated by V. 1667–79 and 1689, including outworks: Fort Français and Fort Louis.
Béthune	62	V. improved it.
Bouchain**	59	Captured 1678. V. rebuilt the medieval wall. Later captured by Marlborough.
Bouillon*	Belgian Ardennes	Became Fr. 1676: V. fortified it 1679.
Boulogne	62	V. improved it.
Calais**	62	Citadel built for Henri IV by Errard de Bar le Duc; improved by V. 1677–90. Fort Risban at entrance to the port built 1640 and 19th century. Fort Nieulay is V's classic brick quadrilateral at the junction of several canals, 1678–79.
Cambrai	59	V. improved the Sp. fortifications 1678.
Charleroi**	Belgium	Started by Sp. 1666, captured by Fr. 1667 when V. completed the fortifications and set the street plan. 1673 V. founded lower fortified town. All modified 1693–97. Fr. demolished fortifications 1748.
Charleville	08	V. improved it.
Clermont (en Argonne)	55	V. helped fortify it 1652.
Condé sur l'Escaut	59	V. helped fortify it 1655; defended it 1656; wanted its recapture 1668 (it happened 1676), then did a big update 1678, with plentiful inundations.
Courtrai	Belgium	V. improved it.
Dieppe	76	V. improved it.
Dinant	Belgium	V. improved it.
Doullens	80	Citadel built 1525–98. V. improved it.
Dunkirk	59	Purchased 1662; V. built fortifications 1668 and 1671, dockyards 1678 and 1689.
La Fère	02	V. improved it.
Givet (Fort de Charlemont)	08	V. doubled the Sp. 1560 *enceinte* of Fort de Charlemont 1678. Lost to van Coehoorn 1696. V. proposed an entrenched camp 1697.
Gravelines**	59	Built by Italian Oligiati 1540–55; improved by V. 1699 featuring double sluice for inundations plus numerous outworks; completed 1731–51.
Guise	02	V. rebuilt it.
Knokke-Brug* (**'La Kenoque'** in Fr.)	Belgium	Built by V. 1678 at junction of river Yser with the Yser canal. Outworks and moat added 1690–92. Demolished by Joseph II, 1781.
Landrecies*	59	Fr. in 1659: Sp. bastions strengthened, then transformed by V. 1673–92.
Lille**	59	Captured 1667. The pentagonal citadel was V.'s first big achievement 1668–73, eclipsing de Clerville's plan. V. appointed governor several times and improved inundations, urbanization, etc. 1682 and 1702.
Longwy	54	Fr. obtained it 1678. V. created a new town from scratch 1678–79, on chequerboard pattern with hexagonal *enceinte*, *orillons* and hornworks. Fr. retained it by treaty 1697. (The defences did well in 1914.)
Luxembourg*	Luxembourg	Fr. captured it 1684; V. rebuilt it 1690.
Maastricht**	Netherlands	Captured and V. planned new defences 1673: lost by treaty 1678.
Mardyk	Belgium	V. rebuilt it 1657.

Maubeuge	59	Acquired 1678. V. fortified it from scratch 1678 and 1783–84: 7 bastions with cavaliers. Considerable additions in the 19th century.
Menin**	Belgium	Captured 1667, V. re-fortified it 1679, but returned to Sp. 1706. Reoccupied 1744, demolished by French 1748, then rebuilt, re-demolished etc.
Mezières	08	V. rebuilt it.
Mons	Belgium	V. strengthened it 1691.
Montmédy	54	V. updated the 1550 Sp. fortifications and lower town 1680–1700, and wrote a memoir 1698. Additional fortification in 19th century.
Montreuil 'sur Mer'	62	V. completed the *enceinte* 1678, alongside the Henri II citadel.
Mouzon	55; near Stenay	V. had written a memoir by 1698; but nothing built.
Namur**	Belgium	V. took it 1692 in an epic siege and rebuilt it with advanced lunettes. Van Coehoorn retook it 1695, but lost it by treaty. V. improved it 1703.
Nieuport**	Belgium	Changed hands many times (it was Fr. at Treaty of Ryswick 1697, as was Ostend). V. toured the area and extended the inundations 1702.
Oudenarde**	Belgium	Fr. took it 1667. V. rebuilt north-east side 1670–74. Demolished 1782.
Paris	75	Fortifications demolished 1670 as king went to Versailles. V. writes memoirs for a double *enceinte* 1686 and 1689; it was built 1840–43.
Péronne	80	V. improved it.
Phippeville	Belgium	V. rebuilt it.
Le Quesnoy	59	Captured 1657. V. modernized Sp. fortifications 1668 and added inundations. A hornwork added in 18th century. (New Zealanders took it 1918.)
Rocroi	08	Built 1555. V. did two inspections, but few of his ideas were executed. Other additions in 18th and 19th centuries.
Sedan*	08	Fr. in 1642; V. visited three times 1682–90 to complete its 1559 fortifications.
Stenay	55	By 1698 V. had written a memoir on it, but no action taken.
St Omer*	62	Captured 1677 and fortified by V. with inundations to north. Demolished 1889.
St Venant	62	V. improved the fortifications.
Tournai**	Belgium	Recaptured by Fr. 1667. V. built 10 bastions, a citadel, four hornworks, vast barracks, etc., incorporating existing medieval walls. Demolished by Joseph II.
Valenciennes	59	V. improved the fortifications.
Verdun*	55	The 1624 citadel and 1675–78 fortress improved by V. 1680 with a town *enceinte*, including barracks and water features, e.g. Pont-Ecluse de Saint-Armand – but his plans completed only in 1823–50!
Veurne (**Furnes** in Fr.)	Belgium	V. improved it.
Ypres**	Belgium	Became Fr. 1678. V. rebuilt the town wall 1678–84, plus other works up to 1689. Projects for an entrenched line to the Lys 1693, and for navigation to the sea 1705. Fortifications slighted 1782–1855 (not to mention 1917).
2. Eastern Frontier (38 cases, or 24 per cent of the total)		
Alt Brisach	Germany	Became Fr. 1639. V. worked there 1663–64. Scandal over alleged fraud: he is cleared 1671. Then (reluctantly) V. re-built it in two more visits but by 1683 he thinks it (and Fribourg) were useless charges on the state. Lost in Treaty of Ryswick 1697. Recaptured 1703; given back 1715. Razed 1741.
Auxonne*	21 (Franche Comté)	Captured 1673, when d'Aspremont began work on bastioned enceinte and arsenal (V.'s role 1673–75 not clear). V. made new plans 1677.
Belfort*	90	Fortified 1636 and became Fr. 1648. To be razed 1673, but V. objects and wants postponement. He inspected 1675–76, 1677, 1679 and 1781. 1687–1705 he added town wall with bastioned towers and hornwork at the citadel. Also built a hornwork on overlooking Miotte hill. Some of his plans still being built 1789, 1793, and even in 1871 siege. Much enlarged since.
Chateau Belin	39; near Salins	V. improved it.

Besançon*	25	V. planned it 1668 but Sp. built it until it became Fr. 1674. V. returned 17 times 1674–1703. Improved the citadel on Gaulish 'Mount Coelius'. His first bastioned towers in town *enceinte*. Battant Crownwork and modifications to Griffon Fort. Many later additions.
Bitche***	67	Medieval fort captured from Lorraine 1679; V. built a fort on the hilltop 1679–81 (also 1683). Lorraine gets it back at Peace of Ryswick 1698. Fr. again 1701–14, then dismantled. Refortified 1737–54: town wall built 1844–55.
Fort Chandane	25; near Besançon	V. built it 1674.
Dôle	39	V. improved it.
Einsisheim	68	By 1698 V. had written a memoir on it.
Freiburg	Germany	Fr. in 1677; V. built it up. Lost by treaty 1697. Demolished 1744.
Granville	25 (Franche Comté)	V. improved it.
Huningue*	68	V. built it from scratch 1679–82 (five bastions and two hornworks). A fort added on right bank of Rhine 1684–86 (with bridge). Besieged 1696–97. Fort demolished by treaty 1697. V. inspected the rest 1702. Fortifications dismantled after 1815.
Fort de Joux*	25	Fr. capture it 1668 and 1674. V. modernizes it 1690. 19th-century additions.
Kehl***	Germany	Became Fr. 1679. Masonry fort built 1681–82 by Tarade, to V.'s plans. Given to Baden 1697. Recaptured 1703 but given back 1713–14.
Landau	Germany	V. built it from scratch 1687, with bastioned towers, two big hornworks, innovative town planning and pentagonal citadel (but against V.'s advice).
Landskron	68, south-west of Basel	Fr. in 1663: the medieval castle was modernized by V. 1680–84: demolished by Austrians 1814.
Langres	52	Ancient fortification. V. planned an entrenched camp 1698 – built only in 1830s.
Lichtenberg	67	Medieval castle modernized 1590, then 1681 by V. Only one ravelin completed of his grandiose plan, so he thought it should be razed. Shot to bits 1870.
Fort Louis	67; on Rhine	Built from scratch 1686 by Tarade and V. (who had preferred Seltz but was overruled). Quadrilateral with two hornwork bridgeheads. The one on right bank was destroyed 1697 and 1714. By 1698 V. had written a new memoir on it. Resisted siege 1705–06. Renamed 'Fort Vauban' in French Revolution. Blown up 1793–94.
Marsal*	57; near Nancy	Became Fr. 1632. V. recce'd and reconstructed it 1663. Demolished 1681. V. rebuilt it, including inundations, and by 1698 had written another memoir on it. Further 19th-century additions.
Metz*	57	V. modernized it 1675 and by 1698 had written a new memoir. His work completed only 1728–52 (with Cormontaigne's additions).
Montbéliard (Comté of)	25	V. inspected 1676.
Mont-Brézille	25; near Besançon	V. built it 1674.
Mont-Royal	Germany	Built by V. against his advice on an island in the Moselle, 1687–90.
Nancy	54	V. was in garrison here 1659. Fortress demolished by treaty with Duc de Lorraine 1661–62: V. and Siffredy demolish the old town.
Neuf Brisach*	68	Tarade built it from scratch 1698–1713 after V. had submitted three plans to the King 1697–98. Considered the highest expression of V.'s art. Canal de Rouffach added 1699. V. inspected 1702 and 1703; work interrupted when town captured 1703, then completed 1708 with Cormontaigne's mid-18th century additions.
Petit-Pierre	67	Tiny town and medieval castle in Basses-Vosges, modernized by V. 1680–84.
Phalsbourg	57	Became Fr. 1661. V. worked there 1663–64 and his project approved 1679. Revisited 1680 and 1683. Ornamental gates and street plan determined by fortifications.
Philippsbourg*	Germany, Rhine right bank	V. captured it 1688, added crownwork, hornwork, and bridgehead on left bank. Razed 1801.
Pontarlier	39	V. expanded the ancient works from 1690. Additions in 19th century.
Salins les Bains	39	V. repairs fort on Mont St André, damaged in previous siege, also other fortifications to south-west 1674. Expanded in later centuries.

Sarrelouis	Germany	Fortified by V. 1680.
Sélestadt	68	Ramparts razed 1673, replaced by Tarade's *enceinte* 1675. V. visited 1677, worked on it 1779, and opened Canal de Châtenois. Fortress (eight bastions and complex inundations) completed 1691. V.'s new memoir by 1698. Dismantled 1874.
St Louis	67	V. built the fort.
St Menéhould	51	V. helped rebuild it 1653.
Strasbourg* **	67	Dan Speckle's original fortifications improved by V. (including new citadel and sluice system) 1681, when it became Fr. After 1686, his citadel completed by Tarade, although V. visited the works eight times. Many 19th-century additions. Largely razed 1930.
Thionville	57	V. built it 1690.
Toul*	54	V. planned modernization 1675 and 1698, executed only 1700 (polygonal nine-bastioned wall), but completed only in 1850s. Many late-19th-century additions.
3. Alps and Mediterranean (29 cases, or 18 per cent of the total)		
Antibes*	06	1682 V. doubled the *enceinte* of the 1580 '*Fort Carré*' and modernized the 1608 town walls. The work finished only 1730s. Fortifications all dismantled 1889.
Briançon*	05	Several modernizations 1590–1690. Then after a big fire V. built a new city 1692–1700, with reinforced *enceinte*, *demi–lune*, *contregarde* etc. Significant additions in later centuries.
Cannes – Les Iles de Lérins*	06; (a) to south is medieval monastery on Ile St Honorat. (b) to north is Ile Ste Marguerite.	In 1682 V. modernized the 1632 Sp. work and Richelieu's 1637 Fort Royal (the prison for 'the man in the iron mask').
Casale	Italy	V. visits and improves it 1682. About 45 miles east of Turin, it was notoriously difficult to access from France and V. wanted to be rid of it.
Castellana	06	V. improved it.
Cette	34	V. fortified it 1678.
Château Queyras	05	V. modernized it 1692–1700.
Col de Nice	06	V. improved it 1691.
Colmars les Alpes	04	Medieval walls redesigned by V. 1692–93, and built by Richerand. The town wall linked by *caponnières* to two outlying forts (Fort de Savoie above and Fort de France below). Eight towers in the town *enceinte*, each of a different epoch!
Embrun*	05	Lost to Savoy 1692 then Fr. recaptured it. V. rebuilt it 1693. Demolished 1882.
Entrevaux	04	Medieval town. New fortifications planned by V. after Piedmontese invasion 1690: Niquet did the work. Citadel plus hornwork and two bastioned towers.
Exilles*	Italy	Modern fortifications from 1600 onwards. V. rebuilt it. Lost to Savoy 1708; recaptured 1796; then razed 1800. Piedmont rebuilt it from 1818.
Fenestrelle*	Italy	V. rebuilt it from 1694. Given to Savoy 1713 and later enlarged.
Fort Barraux*	05	Built in 16th century by Piedmontese (Ercole Negro). Improved to V.'s plans 1692–1700.
Fort l'Ecluse*	01	Became Fr. 1601. V. planned improvements that were gradually built in later years. Destroyed 1814, rebuilt by Haxo.
Gap	05	V. fortified it 1693.
Grenoble*	38	Modern fortifications 1620 extended to west 1670. V. did a complete make-over 1691–1700. Many later additions until demolished in 1920s.
Marseille	13	After urban revolts 1658 and 1660, the king told de Clerville, then V., to build two notorious citadels (St Jean 1660 and St Nicolas* 1660–63 and 1666) on either side of the old port. In 1701 V. said the 1524 Chateau d'If was impregnable.
Mont-Dauphin*	05	V. built it from scratch after site chosen by Mal. Catinat, 1691–93. V.'s plans executed throughout 18th century (and d'Arçon added a new lunette, etc. 1791).
Pignerol	Italy	V. visited it 1669, 1670 (and inspected all Savoy), and 1682; fortified it 1691.

Seyne les Alpes	04	V. designed the citadel 1693: built by Niquet and Richerand.
Sisteron	04	Built by Errard de Bar le Duc for Henri IV. V. planned grandiose extension 1693, but only the powder magazine built.
St. Quentin	38	V. improved it.
St Tropez*	83	Became Fr. 1672, when V. modernized the citadel of 1593–1604.
Toulon*	83	Colbert's premier naval base: 1678, 1682, V. added Fort de l'Eguilette and Fort de St Louis, plus town wall especially to west (now gone), plus dockyards. Not complete by 1707. Many additions (especially detached forts) in 18th century.
Turin	Italy	V. fortified it from scratch, then it reverted to Piedmont. Failed Fr. siege 1706.
Verceil	Italy	V. built it.
Villefranche	06	Built 1557 by Duke of Savoy as his only port. V. later improved it.
Fort St Vincent (or St Vincent les Forts)	04	V. built it 1693, with Richerand. Also a 'Tour de Guet' or watchtower. Much modified in later centuries.
4. Channel and Atlantic coast (23 cases, or 14 per cent of the total)		
Belle Isle citadel* (defending port of Le Palais)	56	When Fouquet improved de Gondi's 1549 fortifications he was disgraced for excessive spending. In three visits 1682–89 V. improved the citadel and the 'envelope walls', built barracks and magazines, plus 19 batteries (68 guns); but Le Palais town wall not built until 1803. V.'s buildings captured and destroyed by the English 1761 after a six-week siege.
Blaye*	33	Citadel begun by Pagan 1652; V. and Ferry expand it 1685–89. Citadel on right bank of Gironde, plus Cussac-Fort Médoc on left bank (trapezoid with four bastions, plus *demi-lune* in front of Port Royale), with Fort Paté* 1691–95 on a sandbank in the middle (suffered 2m subsidence 1707).
Bordeaux	33	Royal citadel (Chateau Trompette*) built with great ornamentation, to control the population from 1660. Suburbs flattened to clear the glacis from 1675. V. improved it 1680–91. Much hated. Demolished 1816.
Brest*	29	Fortifications from 15th century boosted by Richelieu and Colbert: de Clerville made an *enceinte* and 'grid plan' 1666–68. V. 'corrected' it 1683, and fortified 'Le Goulet' channel (V. compared it to the Dardanelles) and put coastal batteries along north coast: Bertheaume and Camaret (semi-circular battery and four-storey 'medieval' infantry tower – '*tour dorée*' – where English beaten off 1694). V. revisited 1685 and 1689. Entrenched camp added 1694 (when V. was the commandant of Basse-Bretagne), plus new memoir on Le Goulet 1695. V. fortified Quelern (south-west entrance to Brest) 1694. Many later additions to the Brest defences until the whole lot bombed to bits in World War II.
Brouage	17	D'Argencourt fortified it 1634–40 (seven bastions, two *demi-lunes*). V. rebuilt it 1681.
Carentec	29	V. (helped by Garengeau) rebuilt the 16th-century Chareau du Taureau as a casemated gun battery at sea level, defending the bay of Morlaix.
Cherbourg*	50	V. started major building works 1686–87. Countermanded (and demolished) by Louvois 1688–89, then revived 1692 after Fr. naval defeat at Barfleur. His plans for forts on Le Homet, Ile Pelée and Le Rocher des Flamands not executed. Major work (which bankrupt Louis XVI) resumed after English raid in 1758.
Concarneau	29	A 15th-century fortification to which V. added *demi-lunes* facing inland and lowered and strengthened the gun towers etc.
Dieppe	76	V. improved it.
Fort La Latte	22	On Cap Frehel: V. wanted to use the 14th-century castle as an outwork to St Malo: built towers for musketry and bastions for cannon vs ships.
Le Havre	76	V. improved it: worried by mortar bombardments starting fires in town.
Ile d'Aix	17	V. planned fortifications 1692; work discontinued 1700 (until 1757 when Montalembert ranges free). But V.'s *demi-lune* at Fort de la Rade* was completed.
Ile d'Oléron	17	Château d'Oléron*: citadel built 1633; de Clerville added second *enceinte* 1673. V. repaired and improved it (with hornworks) 1685–88 using the engineer Ferry. V. also built Fort du Chapus (or 'Chapuis', or Fort Louvois) 1694 – a horseshoe battery and

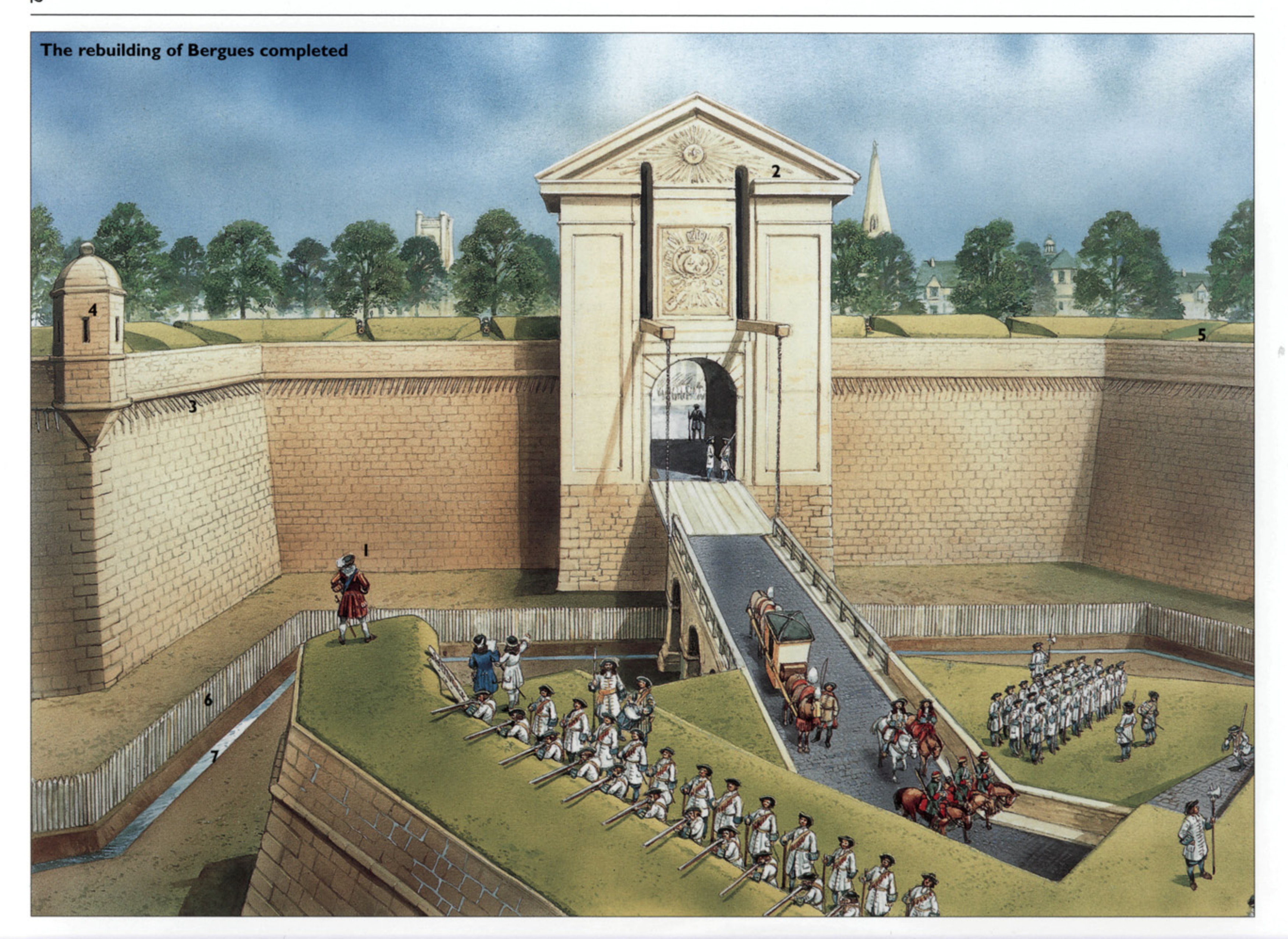
		tower surrounded by sea. Also towers at Chassiron. 1691–1704 town walls begun but never finished. Earth batteries at Pointe de Saumonard and Boyardville (masonry added only in 19th century).
Ile de Ré	17	Access to La Rochelle, Brouage, Rochefort (created by Colbert 1666) is via Pertuis Breton (Vendean coast) and Pertuis d'Antooche (between Ré and Oléron). Ré fortified 1625 by d'Argencourt. V. visits 1674. 1681–85 V. improves the 1625 citadel* (four bastions and *demi-lunes*) and builds town walls of St Martin de Ré* (six *orillon* bastions with *demi-lune*). 1685 V. improved Fort de la Prée* (built by d'Argenton 1625–29; given second *enceinte* by Blondel 1655 then improved 1672–74 by de Clerville); plus V. made redoubts at Sablanceaux aux Portes and Martray.
Isles Houat (x 2) and Hoëdic	56	V. fortified them from scratch 1683 as cover to Belle-Isle. Towers for musketry and bastions for cannon vs ships. Destroyed 1746, then rebuilt.
La Rochelle	16	V. modernized it.
Mouth of the Charente	17	After Dutch raids 1674, V. designed and Ferry built Fort Lupin (a semi-circular battery around a redoubt in wet ditch, 1683), Fort de l'Ile Madame, and Fort de Piedmont (1695–1704).
Port en Bessin	14	V. improved it.
Port-Louis	56	Medieval forts upgraded 1616 and 1622. V. found it all wrong but added only minor improvements e.g. a powder magazine.
Rochefort	17	V. built a (very) few fortifications 1675–92, improving the fortifications and new town of Blondel and de Clerville.
St Malo	35	V.'s grandiose scheme executed by Simon de Garangeau 1689. Medieval towers replaced by bastions, chateau and town ramparts modernized. Detached forts built: Fort National, Fort du Petit-Bé (or Bey), Fort d'Harbourg, Fort de La Conchée. Minor fortress at Chateau Neuf-St Père designed and built after 1760.
St Vaast-La Hougue and Fort de Tatihou	50	V. re-fortified them 1698–1701 after battle of Barfleur 1692. Towers for musketry and bastions for cannon vs ships.
5. Pyrennes (12 cases, or 8 per cent of the total)		
Bayonne*	64	Built by Louis XII and Francis I. V. improved it 1674, 1681; and added citadel on right bank of Adour (built by Ferry). Outworks and fortified camp added 1793–1813.
Bellegarde (or Le Perthus)	66	Captured 1674. V. visited 1679 and accepted the plans of Rousselot to increase size of Sp. fort and add a hornwork to south.
Collioure	66	12th-century port: V. supervised building of plans by Saint-Hilaire, especially Fort Miradoux. Also a *fausse-braye* with two demi-bastions beside the chateau and bastions of La Tour Carré and of the Dominicans.
Fort de Socoa	64 (bay of St Jean de Luz)	V. planned (1698) and engineer Ferry rebuilt a Sp. fort destroyed in 30 Years' War. Medieval-style tower with machicolation plus barracks in an *enceinte*. Completed 1723.
Fort les Bains*	66	St Hilaire built it 1670–74: V. rebuilt it.
Mont Louis	66	V. proposed the site, then built it from scratch 1679. Town plan with two parallel main walls, protected by a square citadel.
Navarrenx	64	16th-century fort (Fabricio Siciliano). V. helped rebuild the urban *enceinte*.
Perpignan*	66	Fr. in 1659. V. visited 1669; rebuilt it 1679–86 with the help of Rousselot: upgraded the citadel's second *enceinte* (*demi-lunes* and *place d'armes*) and completed town *enceinte*, adding outworks, etc.
Port Vendres	66	V. built it from scratch 1678.
Prats de Mollo	66	Became Fr. 1659. V. and Rousselot rebuilt it 1686, esp. Fort Lagarde* 150m above the town and la Tour Carré, linked by an underground passage.
Rosas*	Spain	V. helped improve fortifications 1693–97.
St Jean Pied de Port	64	Antoine de Ville upgraded its 12th-century citadel. Then V. proposed a vast bastioned *enceinte* around both suburbs, but only a part was built.
Villefranche le Conflent*	65	Became Fr. 1659. Rebuilt from 1669 by Saint-Hilaire: V. helped with a *grotte* ('grotto') of cannon casemates on south side plus Fort Liberia built 1680 to north with covered steps up from the town (improved in 19th century).

Vauban's pragmatic innovations

Far more often than not Vauban's designs had to incorporate existing older fortifications, which sometimes originated deep in the Middle Ages, but more frequently went back only a few decades. Typically Vauban might direct a siege against some modern Spanish, Dutch, or Imperial fortress and then, immediately after the place had fallen, he would draw up plans for its future development and enhancement by French engineers. Perhaps he would add a citadel or reinforce a front that had been found to be weak during the course of the siege, or perhaps he would wish to expand the whole fortress to fulfil a greater role than had previously been envisaged for it, as part of his wider scheme of national defence. In the course of this process he would inevitably make use of the existing walls, bastions and outworks, so that well over three-quarters of his projects may be considered 'modernizations' or 'improvements' of older works. Very few of his creations were entirely new major fortresses located on the land frontiers, such as Neuf Brisach, which was built from scratch on the left bank of the Rhine as compensation for the loss by treaty of Alt Brisach on the right bank. Considerably more of Vauban's new buildings were on the coastal frontiers, where small (and 'obsolete') forts could be built relatively quickly and cheaply to block key channels.

When improving existing fortresses, a favoured approach was to add a second *enceinte*, or maybe new hornworks or other free-standing external defences that would add depth and complexity to the original basic trace. In some cases, especially in the coastal defences around La Rochelle and Rochefort, he merely surrounded a prominent medieval tower with a low-lying semi-circular gun battery. Such a work might well have been practicable and effective in face of bombardment from a pitching and yawing ship, but it could never have survived for long in the more solid and scientific conditions obtaining on the Belgian or Rhenish frontiers. It was in the latter zones that Vauban laid out his most advanced designs, although he would doubtless not have been embarrassed by the discrepancy. One of the themes that he constantly stressed, following his predecessor Count Blaise François Pagan, was the overriding need to suit the design of fortification to the local conditions and terrain. In the case of a shore battery designed to shoot at ships a moderately unsophisticated design might be best (such as the 'medieval tower' he built at Camaret, near Brest); for warfare in steep rocky mountains there might be little room for bastions but a need for solid towers (as at Château Queyras); in low hills yet another system might be preferable, with perhaps only one likely attack front having to be super-protected by a dazzling array of outworks and *demi-lunes* (as at Namur or Givet). But then again, in flat, well-watered lowlands a spectacular display of all the latest fortification ideas, including 'bastioned towers', complex water features, or masonry-lined pre-dug counter-mines, could be laid out in all their most fashionable majesty.

When it came to the details of fortress architecture it is true that Vauban relied almost entirely upon the work of his predecessors; but he did personally invent at least one new feature, the 'bastioned tower', which he eventually came to prefer to the old combination of an ordinary bastion strengthened, if at all, by only a central cavalier tower. However his new design, being casemated, was considerably more expensive to build than the conventional earth-filled or solid bastion. He used bastioned towers at Besançon, Belfort, Landau, and above all at Neuf Brisach; but they never caught on with other fortress builders. Thus we are left with the paradox, or cruel irony, that



The rebuilding of Bergues completed

Vauban's highest architectural achievement was to all intents and purposes a failure. He was much better at popularizing than at innovating in this field, whereas very much the opposite was the case with his contributions in the field of siegecraft.

Apart from his bastioned towers, Vauban normally tried to set the points of his bastions at an angle somewhere between 75 and 90 degrees, thereby establishing a standard that avoided both excessively acute and excessively obtuse angles. He also generally abandoned the old *fausse-braye* at the foot of the main rampart, in favour of a detached *tenaille* in front of the curtain wall, and/or a *chemin des rondes* along the rim of its masonry scarp wall. As the



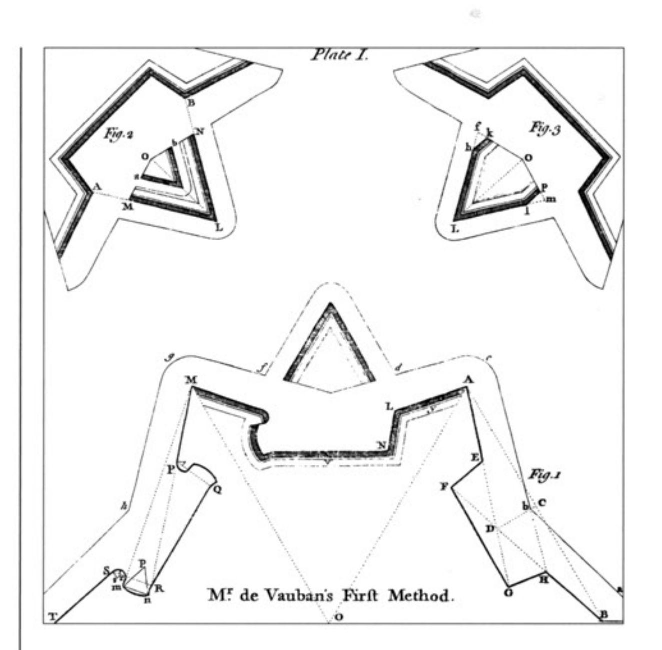
LEFT D'Aspremont's modern bastions and ravelins added to the medieval walls of Auxonne, later improved by Vauban. Note the traverses and *places d'armes* in the covered way in the foreground, and the tactically angled bridge with guardroom in the background. (Christian Carlet at the Musée des Plans Reliefs)

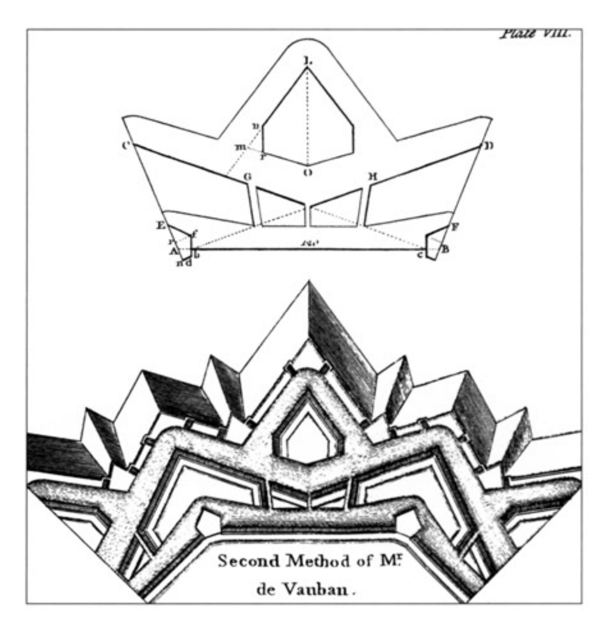


LEFT A series of three traverses blocking enemy artillery fire and infantry movement sideways along the covered way at Fort de Châteauneuf–St Père, just south of St Malo. This was not a Vauban design, being built in 1777, but it reflects exactly the type of traverses that he used. (Paddy Griffith)

LEFT **The rebuilding of Bergues completed**

This illustration shows Vauban **(1)** standing on a ravelin, surveying the completed work on the strengthening of Bergues. In the centre lies the grand ornamental gatehouse **(2)**, which provides entrance to the city, with the symbol of the 'Sun King' at its top. The main rampart features typical defensive elements, including storm poles **(3)**, an *echanguette* **(4)**, and canon embrasures **(5)**, and is protected by a ditch with palisades **(6)** and a water-filled cuvette **(7)**. The garrison are shown drilling, in preparation for a siege.





TOP LEFT Vauban did not himself design or attempt to propagate any 'system' of fortification at all; but others (in this case Müller, 1746) felt they were unable to understand his work unless they could reduce it to a series of such 'systems'. This 'first system' is pretty elementary and leaves key choices unresolved as between *orillons* or straight flanks to the bastions, and between solid or redoubted ravelins. (Charles Blackwood)

TOP RIGHT Müller's idea of Vauban's 'second system' in which bastioned towers and counterguards feature prominently. In the field Vauban applied this 'system' to less than half a dozen of his fortresses. (Charles Blackwood)

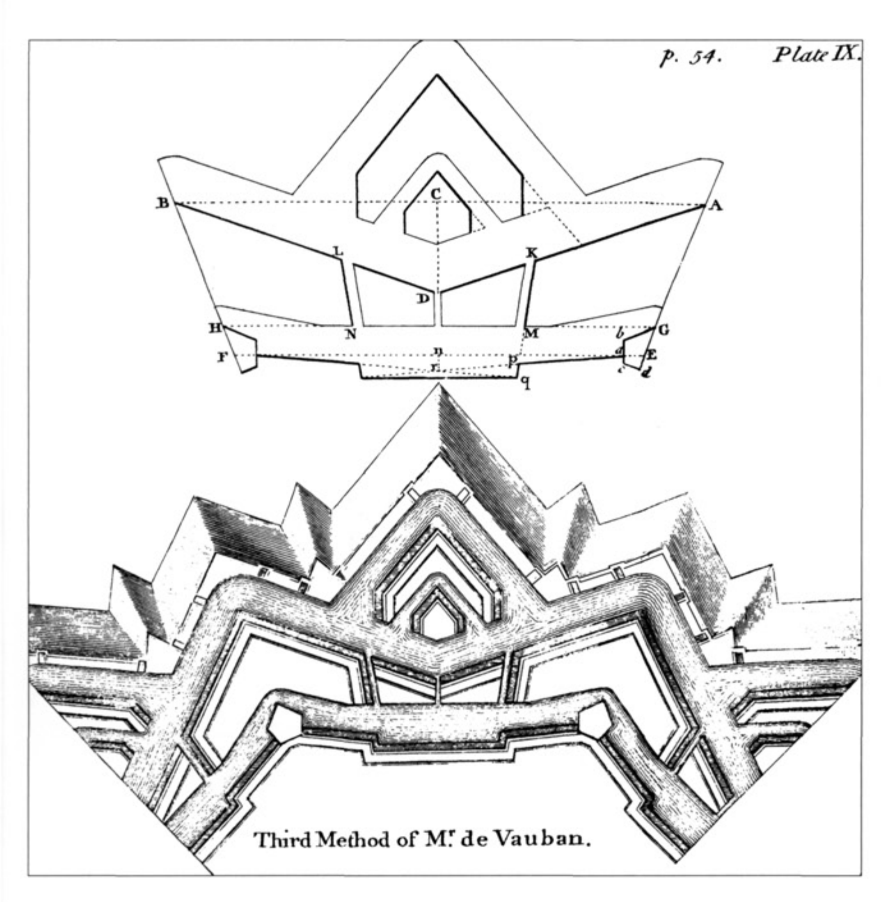
inventor of ricochet fire he naturally tried to break up any open rampart with traverses, berms, or other earthen banks that could absorb grazing shots, although it must be admitted that this was a merely a logical precaution rather than any stroke of genius. Equally humdrum and unglamorous, perhaps, were Vauban's standardized designs for such essential features as barrack blocks and powder magazines);[11] but at least they were robust, very practical and extremely long-lasting.

Vauban also paid particular attention to water obstacles, and was a master builder of tactical sluices, by which critical areas of low-lying ground could be flooded quickly in moments of crisis, but left dry for more productive use in ordinary times. At Strasbourg, for example, the whole southern side of the city was to be protected not only by dozens of demi-lunes and bastions, but also by a vast artificial lake controlled by fortified sluices.[12] Related to this was his considerable experience in building canals – not only completing the big one linking the Bay of Biscay to the Gulf of Lyons, or grappling with the abortive aqueduct intended to bring water from Maintenon to Versailles, but also building the relatively minor Canal de Châtenois or the Canal de Rouffach, which were designed to bring building materials and general supplies to the fortresses of Sélestadt and Neuf Brisach, respectively. One of the achievements of which he was particularly proud was the 'risban' (or 'risberme') work at Dunkirk, which was built on an unstable sandbank and required complex piling as well as special curves to lessen the power of the waves washing over it. (By contrast his 'risban', which may still be seen at Calais, was considerably more straightforward and less exposed to the sea.) Whatever else we may say about Vauban, we should certainly not underestimate his readiness to 'get his feet wet' by undertaking hydraulic works of every type, especially the many ingenious arrangements that he made to flood his fortress ditches whenever it was technically conceivable.

He was also a notable exponent of town planning. Not only would he often build an *enceinte* to define and defend an existing town, but when he was building on a 'green field site' he would lay out a whole new town to fit inside his fortifications. At Charleroi this involved a street plan using triangular blocks; but more famously at Neuf Brisach and other sites he preferred to use an extensive square grid of the same type that would later be taken up in the planning of many US cities.

[11] Duffy, *Fire & Stone*, p.77

[12] See Haettel, *Vauban aux frontières de l'Est*, passim

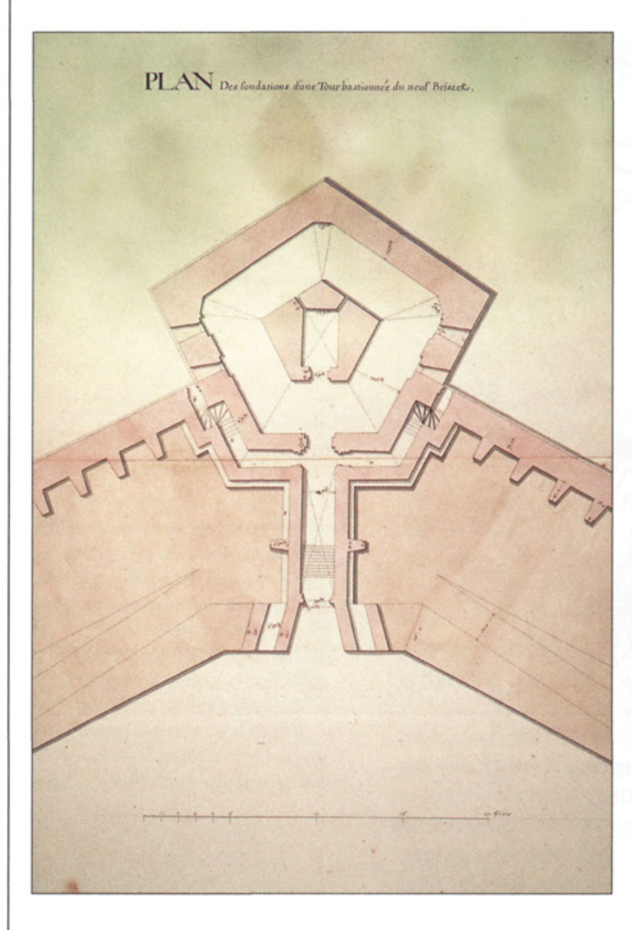


LEFT Müller's idea of Vauban's 'third system', which seems to be almost identical to the alleged 'second system' apart from the use of redoubted ravelins rather than solid ones. In practice Vauban used this arrangement only at Neuf Brisach – and no one else copied it – so it must surely be accounted as an 'experiment' or 'oddity' rather than a 'system'. (Charles Blackwood)

Vauban was an artisan who had to all intents and purposes 'risen from the ranks' in social as well as professional terms. He deeply distrusted any fortress designs that were hatched only in the study, or according to some intellectual system invented by theoretical mathematicians who had never trudged through the trenches in real sieges. Jesuit and other schoolmasters, such as Jean de Breuil, R.P. Milliet de Châles, and not a few members of the German school, whose only interest was to convert fortification into a dry, academic subject, were particularly criticized in this respect. Vauban's own approach was always to look at the ground very closely in person, then to construct a fortification that paid the fullest possible attention to the local conditions. He often complained at the number of miles of walking around each fortification that this entailed, which is a sentiment that the modern fortress tourist can heartily echo and applaud. But above all Vauban emphatically did not see his own work as progressing, as many commentators have alleged, from a 'first system' through a 'second system' to a 'third system'. 'Systems' of that type were strictly for the ivory tower, as far as he was concerned, and he went to some lengths to avoid them in his writings. Instead, he collected as wide as possible a file of potential fortification features, ranging from medieval designs to the most modern type of hornwork, as well as special items like his very own 'bastioned tower'. In any given case he would deploy whichever mixture of these that he felt was most appropriate to the particular problem in hand. He did not feel he always had to use all of them; nor did he feel he had to use the same mixture of features on one face of a fort as he was using on another. He was a pragmatist who perpetually varied his style to suit the local circumstances and the lie of the land.

RIGHT **The fortifications of Charleroi**

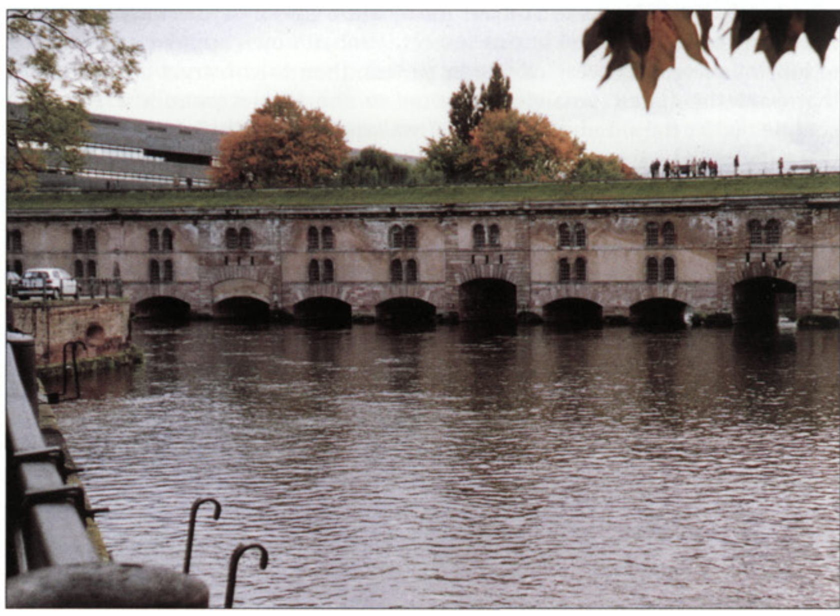
This aerial view of a bastioned trace at Charleroi, a new town constructed by Vauban, demonstrates many typical fortification elements. **(1)** ravelin; **(2)** redoubt in ravelin; **(3)** gatehouse; **(4)** bastion; **(5)** hornwork; **(6)** *tenaille*; **(7)** *lunette*. Note the triangular (as opposed to square) street plan of Charleroi, with the parade ground at its centre **(8)**.



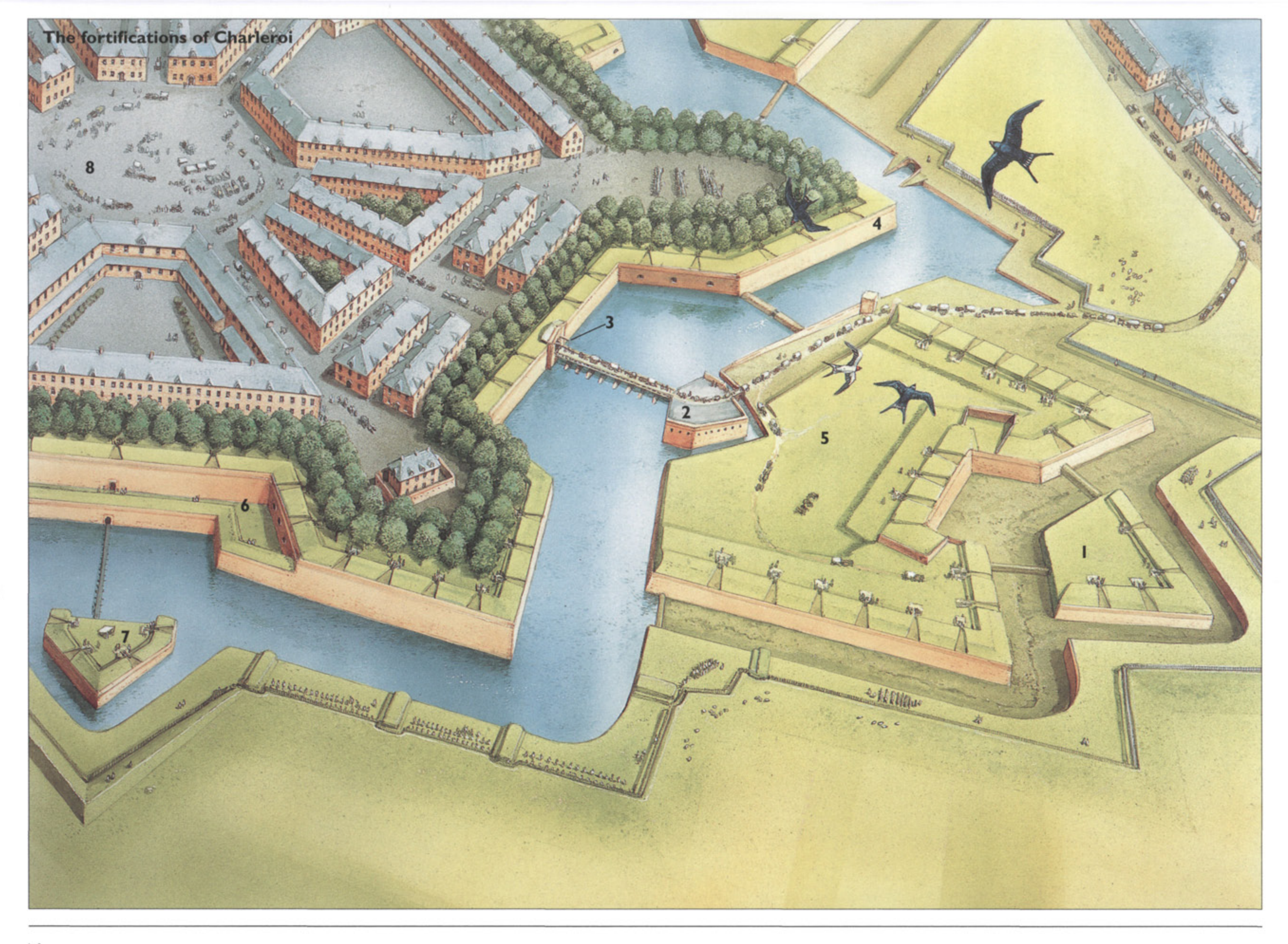


TOP LEFT Architect's plan of a bastioned tower at Neuf Brisach, showing how it was an entirely self-sufficient redoubt, independent of the main curtain walls. Note also the gun ports at ground level. (Documents at the Musée des Plans Reliefs)

TOP RIGHT View from the angle of a bastioned tower at Neuf Brisach, showing the vestigial bastion behind it and the curtain wall behind that. (Paddy Griffith)



RIGHT The 'Barrage Vauban' at Strasbourg – a bank of fortified sluices designed by Vauban and Tarade in the early 1680s, to divert the waters of the River Ill, in time of siege, away from their normal passage to the Rhine and into a vast artificial inundation protecting the whole southern side of the fortress. (Viv Haywood)



The fortifications of Charleroi

TOP A cross-section through ramparts, ditch and counterscarp, showing the key elements. (Peter Dennis)

BOTTOM Plan views of two types of coastal batteries: the round Fort Paté near Blaye (left) and the semi-circular Fort Lupin at the mouth of the Charente (right, not to scale). (Peter Dennis)

The importance of depth defence

Few of the elements that Vauban used were particularly new or his own invention, and to that extent we are entitled to suggest that he was less an innovator than a popularizer of existing themes. Yet the sheer quantity of his work itself represented a sort of innovation in its own right. For the first time there was a single individual designing practically all of the defences of France, and imprinting them all with a single distinctive vision that was subtly different from those of his great contemporaries, particularly the Dutch engineer Menno van Coehoorn or the Swede Erik Dahlbergh. Vauban also believed in defence in greater depth than had most of his predecessors, in both operational and tactical terms. Operationally, he liked to have two lines of fortresses supporting each other 'like the two lines of infantry in a battle formation'. If the enemy broke into the first line, the second line would hold him up until reinforcements could arrive, or divert him into attacking sideways, still in the first line, as we have seen. Vauban was certainly fortunate that his king was usually ready to empty his pockets to provide the necessary resources.

Vauban was also an exponent of depth defence in tactical terms, in that he was constantly pushing the parapet of his most advanced line, the covered way running along the inner edge of the glacis, further and further away from his main gun line on the parapet of the scarp (or principal rampart). Wherever he thought the terrain offered a relatively easy approach to an attacker, he would seek to insert extra hornworks or ravelins into the intervening ground, or even to throw forward detached forts beyond it. If he could put a counterguard around a bastion to 'double up' its defences, he would do so. Thus if the attacker captured one work, he should always find that there was another one covering it from the rear, so the moment of his final triumph would be frustratingly postponed. Walking through the multiple outworks of the more elaborate Vauban fortresses, such as Briançon or the Lille citadel, can remind one strongly of the multiple skins of an onion: behind each one there is always another.

Some authorities such as Viollet le Duc seem to assume that Vauban would also have wished to supplement this 'depth defence' with an aggressive 'active defence' featuring not only counter-sapping by engineers, but numerous sallies with infantry. However, this appears not to have been the case, since Vauban would have seen such a policy as unnecessarily risking the lives of his men. He was always careful to avoid this, in both offensive and defensive siege work, which was a preference that marked him out sharply from many of his contemporaries. Even so, he would at least have approved of an active programme of counter-mining; a policy which did not risk large-scale casualties to the defenders, even though it might be more risky than some other defensive tactics.

One implication of Vauban's belief in tactical depth in his fortifications was that he was often ready to add detached forts outside his main centres of resistance. Such things had of course been known in earlier times; but with Vauban the practice became more widespread, long before the dramatic increases in cannon range during the 19th century would make it unavoidable. Hence we increasingly find clusters of fortifications, sometimes covering a very wide area, rather than just a single *enceinte*. This was particularly the case in coastal defence, where multiple channels leading to a particular harbour all had to be covered by fire, as for example around the Ile d'Oléron and the Ile d'Aix in the approaches to Rochefort; on the Ile de Ré outside La Rochelle; at Brest, Toulon, St Malo, and to a lesser extent the Cherbourg peninsula. Something similar could also be seen in landward fortifications, albeit on a smaller scale – as for example at Briançon, at Bergues, along the line of the Yser canal from



ABOVE The roadway approaching the citadel at Belfort, showing three of the 'layers of the onion' in its depth defences. Vauban was always anxious to add as many layers as possible to any site that he was called upon to fortify. (Paddy Griffith)

Ypres to Nieuport, or at Kehl around the Rhine crossing just east of Strasbourg.

Beyond the idea of detached forts, again taking his cue from his predecessor Pagan, Vauban was moving in his later life towards a system of entrenched camps. The aim was to abandon minor fortresses but to strengthen major fortresses with large fieldworks that could accommodate whole armies, in addition to the normal fortress garrisons. He had planned such camps in a number of towns, such as Langres and Givet. He actually built them in some others, most notably Brest and Dunkirk, although his plan for Belfort would be executed only as late as 1874. Camps of this type would gradually become a very common feature of 18th- and 19th-century thinking and so, once again, even if Vauban was not technically an 'innovator' in this field, he was certainly a very important progressive influence. By the same token he also gave his blessing to the various long, bastioned earthwork 'lines' that started to appear in the Netherlands from 1694 onwards, which culminated in the '*Ne Plus Ultra*' line that was built in 1711, some four years after Vauban's death. Another famous example was the Wissembourg line along the river Lauter at the extreme north-east corner of the modern French frontier. In some of these cases the works might stretch to well over 100 miles in length, normally following rivers or canals, and could act as significant reinforcements to a network of fortresses. They allowed field armies to hold a longer than normal frontage since, if the enemy made a surprise attack, the fortifications could buy extra time for the defender to bring in his troops from a distance and concentrate them behind the threatened point.

During much of his long working life Vauban was responsible for supervising the totality of France's fortifications, which he did by remorseless tours of inspection to see, smell, and touch the lie of the land, after which he would dash off a more or less comprehensive plan for future developments, which others would translate into masonry and earthworks. In a majority of cases his intended improvements were generously – and even recklessly – funded by the government, which was perhaps the single most important factor in his success, as well as creating a significant weight on his conscience. Vauban was well aware that the tax revenues he was spending so profligately were raised by deeply unjust means that in the long run were bound to lead to revolution. He began to write dangerous tracts about this, and towards the end of his life he was even recommending a pruning of the fortress chain itself. Even so, it is hard to believe



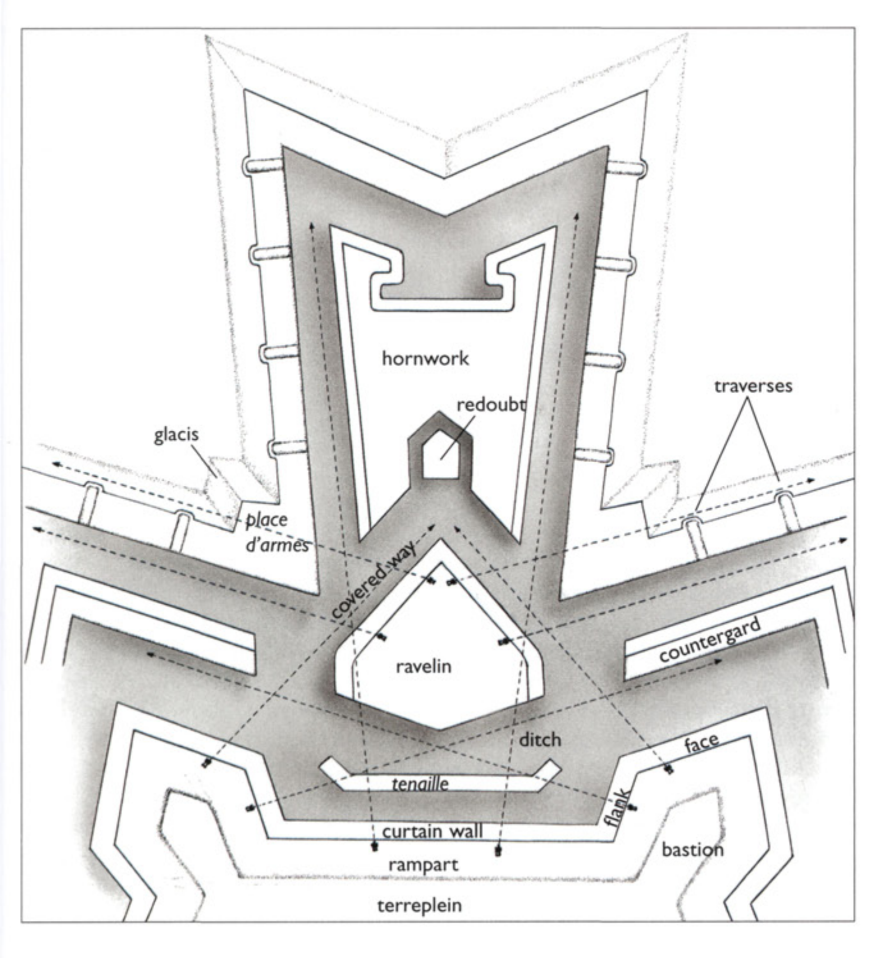
RIGHT Layer upon layer of defences in depth – some of them added long after Vauban's time – all the way up the extraordinary mountain site at Briançon. (Paddy Griffith)

that when faced with any specific project, he could ever resist the temptation to build a yet more perfect fortress. If he had a choice between recommending a small one or a big one, he would surely always tend to opt for the big one – and then throw in a couple of extra hornworks for luck. Even if a significant proportion of his grander projects remained unexecuted for many years after his death, it is amazing that he managed to persuade the king to go ahead with so many of the others.



ABOVE Fort Paté: the purest form of a Vauban coast defence battery, built in the middle of the Gironde estuary with a central 'medieval tower' for accommodation and elevated gun positions, surrounded by a lower tier of embrasures for heavier cannon (in theory a total of 30 guns were mounted). Fire could be delivered to all points of the compass, supporting other, larger, fortifications on each bank of the river, thereby blocking access to the city of Bordeaux. The whole thing was built on a shifting sandbank and required two layers of timber to be immersed in the water for a year before building could begin. Note that it conforms to absolutely none of the supposed 'three systems' conventionally attributed to Vauban's art. (Christian Carlet at the Musée des Plans Reliefs)

The sheer number of his well-funded projects enabled Vauban to leave an unprecedented personal mark not only upon scores of individual fortifications but also, at a much higher level, upon the whole concept of national defence. This in turn meant that after his death in 1707 he left a prodigious legacy that his successors were forced to respect in an almost religious manner. The 18th century was therefore marked more by conservatism in French fortress design than by radical innovations. A significant number of Vauban's plans were finally completed, and new works usually paid homage to his ideas. Admittedly Marc-René Montalembert (1714–1800) pushed forward an 'alternative' concept of multi-tiered casemated batteries, to achieve a much greater fire superiority over an attacker than Vauban had envisaged; but this was translated into practice in so few cases that it did not seriously dent the existing orthodoxy. As late as the 1840s, on the eve of the great artillery revolution of the later 19th century, French engineers were still asking themselves 'What would the great Vauban have done?' far more often than 'How can we adapt to a future that is rushing towards us like an express train?'



LEFT Plan view of two bastions, with a hornwork – one of many possible defensive combinations. (Peter Dennis)

Operational history

Out of Vauban's total of some 160 fortresses or fortress projects, it is impossible to make meaningful generalizations about their operational history, except to say that the pressure of enemy attacks built up successively with each new war that Louis XIV fought, and each new enemy that he activated against himself (see Table II below). From the mid-1650s to the truce of Regensburg in 1684, the initiative had lain almost entirely with the French, as the young king flexed his military muscles and Vauban himself began to demonstrate his brilliant new art of siege. In this era the ill-prepared enemy fortresses seemed to fall like ninepins, and it was only the desperate, last-minute flooding of the approaches to their heartlands that saved the Dutch from total occupation in 1672. As each new fortress fell, Vauban would attempt to rebuild and strengthen it, although in some cases he might soon find it was returned to its previous owners by the peace treaty.

Table II: French Wars during the life of Louis XIV	
1618–48	Thirty Years' War (but no peace with Spain in 1648).
1649	First Fronde.
1650–51	Second Fronde.
1651–53	Third Fronde.
1659	Treaty of the Pyrenees ends hostilities with Spain, favourably for France.
1665–67	Second Anglo-Dutch War (France supports the Dutch against England and Austria) ends with the Peace of Breda.
1667–68	War of Devolution (France against Spain) ends in Treaty of Aix la Chapelle, which gives France many barrier fortresses on the Belgian frontier.
1672–79	Great Dutch War (France, Sweden and initially England against United Provinces, Austria, Spain, Brandenburg, etc.) ends in Treaty of Nijmegen, which gives France Franche-Comté and more towns in the Low Countries.
1681–84	War of Reunions (France against small states e.g. Luxembourg; then Spain and United Provinces) ends with the Truce of Regensburg, still favourable to France.
1688–97	War of the Grand Alliance (or 'War of the League of Augsburg': France against almost everyone, including Savoy) ends in Treaty of Rijswijk, with France surrendering many key frontier fortresses.
1701–13	War of Spanish Succession (France once again against almost everyone but with Spain, Portugal, Savoy and Bavaria as initial allies) ends in Treaties of Utrecht and Ratstatt – something of a draw. Meanwhile there is the bloody internal Revolt of the Camisades (i.e. Protestants in the Cévennes), 1703–11.

By contrast in this early period the enemy's attacks on French fortresses were generally clumsy and sorry affairs, which won practically no success apart from the capture of Bonn in 1673 and Philippsburg in 1676. Typically the French would use their superior logistic organization to launch their offensives in the early spring, before the enemy was able to enter the field at all. Then in the summer and autumn when the enemy tried to regain the forts he had just lost, the French would be able to frustrate him by purely defensive manoeuvres. Their field army would be able to relieve any of their own garrisons that were threatened, and so it would go on, year after year, with Louis XIV extending his territory unstoppably, methodically and apparently almost mechanically.

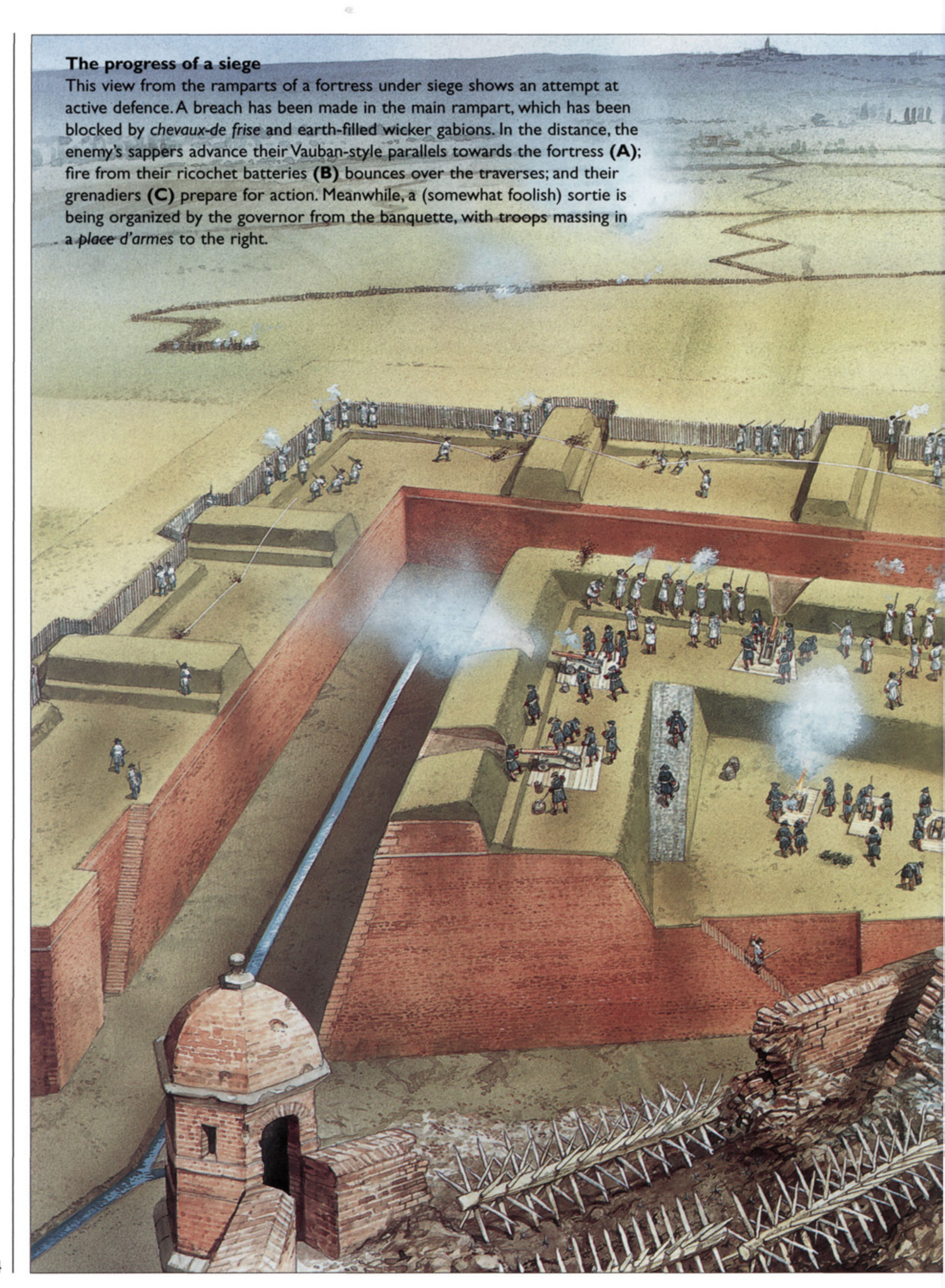
During the following two decades, however, the balance gradually shifted as the enemy alliances became bigger and more powerful and their chief engineers – notably Menno van Coehoorn for the Dutch – became more skilled in both the attack and defence of fortresses. In this period the French army

increased in size to over 400,000 men, and Vauban was finally allowed, after years of petitioning, to form something approaching a professional corps of sappers and miners, albeit still very small. His fortresses were in splendid condition after millions had been spent on their building and upkeep (£12,700,000 in the year 1689 alone); and yet he could sense that the earlier French predominance was slipping inexorably away. He quite correctly saw the enemy alliances as 'disfunctional machines' in which the various component parts each tended to do their own thing without reference to any of the others; but the acid fact remained that the French were steadily and progressively being pushed onto the back foot. They were having to shoulder an increasingly heavy burden of debt merely to stand still, and they faced a very real danger of overstretching themselves operationally. Worse still, the enemy had fully absorbed and understood Vauban's innovations in the art of siege.

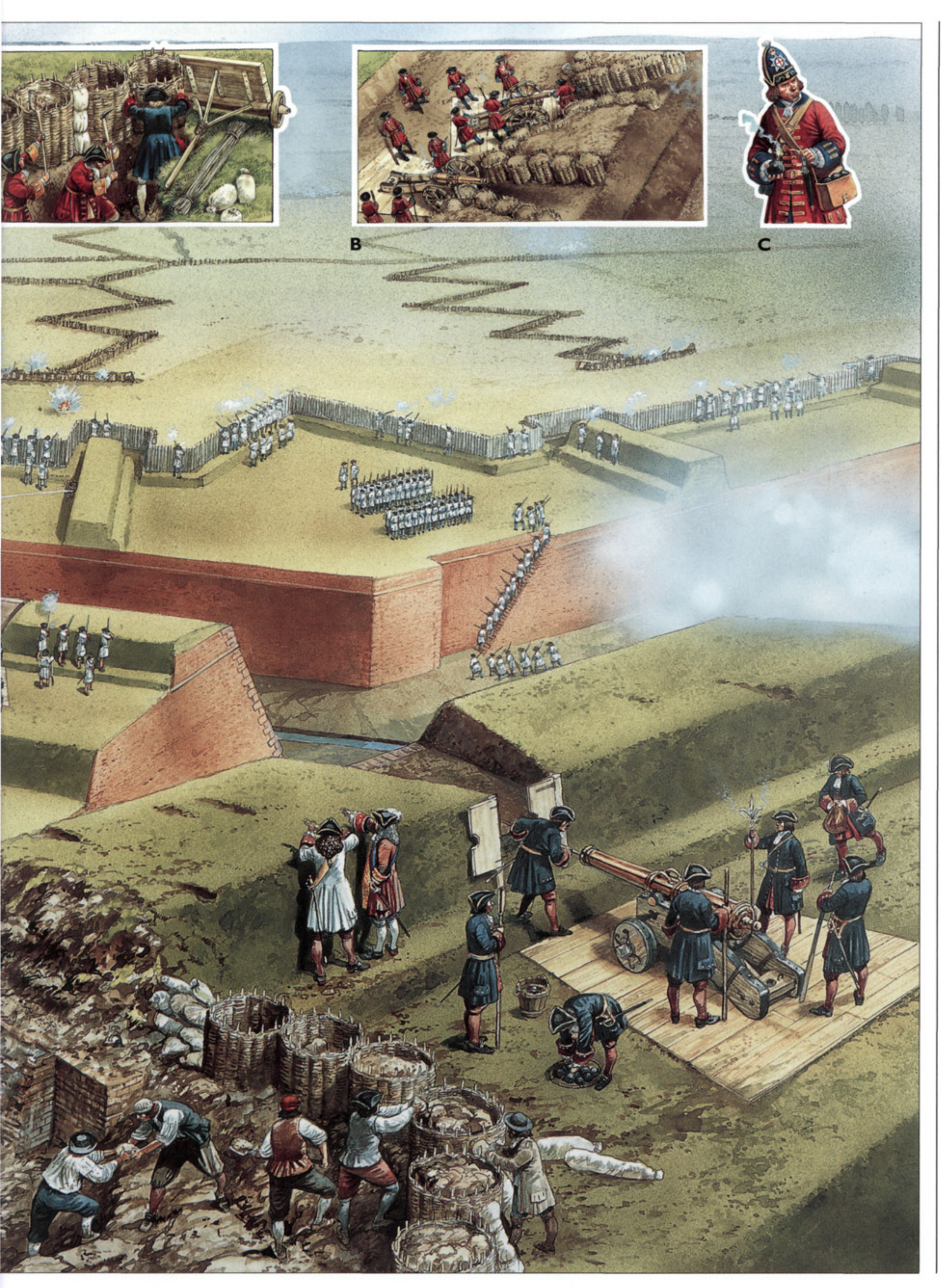
The War of the League of Augsburg, 1688–97, may be seen as a time when the two sides were relatively evenly balanced. In 1689 Coehoorn was able to capture Kaiserworth in just two days, and then eventually Bonn. The French were meanwhile still continuing to make significant and sometimes spectacular advances, including the recapture of a number of fortresses that Vauban himself had strengthened. In 1694, however, Coehoorn struck again to take Huy, following through in 1695 with a hurricane bombardment of Namur which led to the embarrassingly rapid capitulation of that place. This came as a great shock to the French, and forced Vauban to mount a full analytical post-mortem to preserve his own reputation as a fortress builder. We may perhaps find it slightly odd that this reputation had not already been called into question when he had himself already captured some of his own earlier works, but in the case of Namur it was the enemy who had defeated one of his most important garrisons, so the matter was seen as a great deal more serious. More seriously still, the enemy refused to make peace on French terms. There was a major shift in the balance of power at the Treaty of Rijswijk in 1697, when the French had to surrender such hard-won frontier fortresses as Mons, Ath, Charleroi, and Luxembourg in the Netherlands; Casale and Pinerolo in Italy; Barcelona in Spain; all the places on the right bank of the Rhine, and their claims to the duchy of Lorraine.

The king nevertheless persisted in his lust for further confrontations, and as early as 1701 had plunged France back into the cauldron by accepting the War of Spanish Succession. It began well with the immediate occupation of all the Spanish fortresses in Belgium that had caused so much trouble in the past; but these were generally weak and badly maintained, so they soon began to be picked off by allied counter-attacks, including those delivered by the British general the Duke of Marlborough. The French defeat in the field at Blenheim in Bavaria in 1704 was a major blow, but it was at least reassuringly far from Paris. Equally the French defeats in north Italy in 1705–06 were still remote from the centre of power. It would be in 1706–08 that things went badly wrong much closer to home, in Belgium. First there was a real novelty in the wake of the battle of Ramillies in 1706, when a whole series of Franco-Spanish fortresses surrendered in short order, almost without a show of resistance – Oudenarde, Malines, Brussels, Bruges, Ostend, Menin, and Ath. However these were mainly poor Spanish fortresses that had been badly maintained despite Vauban's attentions.

Then in 1708 came another thunderclap when the French lost the field battle of Oudenarde, after which Lille itself was captured at the end of a three-month siege. Vauban himself had just died; but he surely turned in his grave at this, since the capture and fortification of Lille had been one of his proudest early achievements, and he had been governor there on several occasions. It was at this point, however, that the full value of his wider system emerged, since the allies soon found that it was far easier to launch subsequent attacks sideways into Vauban's first line of fortresses than it was to venture forward into the second line, let alone capture the main prize of Paris. This process



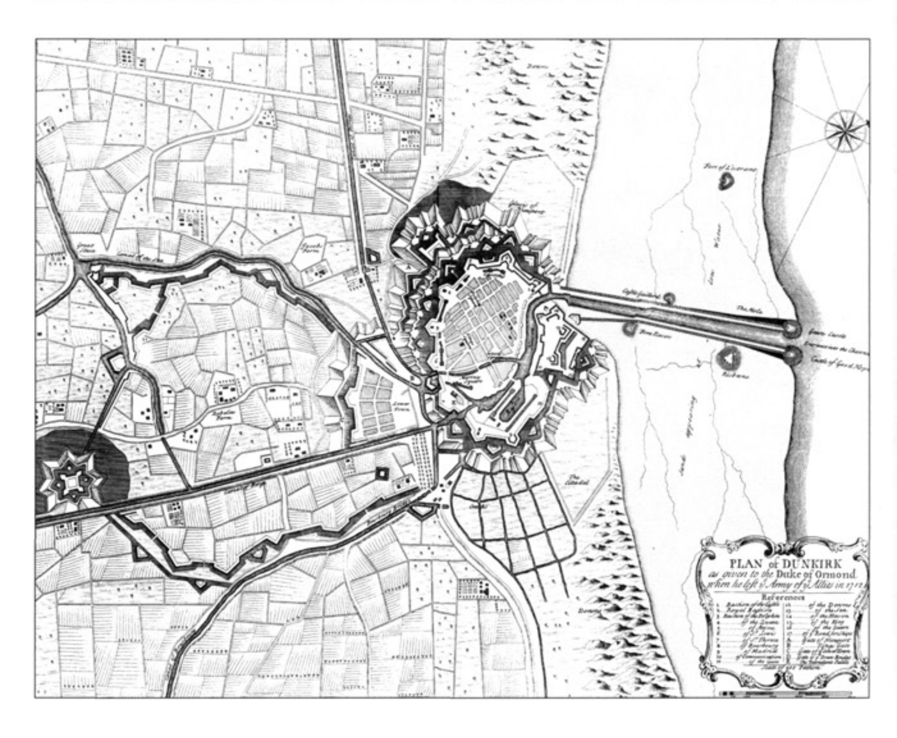
The progress of a siege
This view from the ramparts of a fortress under siege shows an attempt at active defence. A breach has been made in the main rampart, which has been blocked by *chevaux-de frise* and earth-filled wicker gabions. In the distance, the enemy's sappers advance their Vauban-style parallels towards the fortress **(A)**; fire from their ricochet batteries **(B)** bounces over the traverses; and their grenadiers **(C)** prepare for action. Meanwhile, a (somewhat foolish) sortie is being organized by the governor from the banquette, with troops massing in a *place d'armes* to the right.


B
C

wasted several years of campaigning and eventually allowed the French to make peace on relatively even terms, for which they owed a very great deal to Vauban's rationalization of their defences in his *Pré Carré*. And indeed almost exactly the same could be said of the 1790s when, after the first direct attack on Paris had been repulsed at Valmy, the allies frittered away their advantages in 'sideways' attacks on Vauban's chain of frontier fortresses, until they were eventually swept back out of the Netherlands altogether.

As a higher conception of national defence, Vauban's *Pré Carré* was a great operational success, but the same was not always true of the individual fortresses within it. The ability of any given fortress to resist attack depended on many factors apart from its architectural design, such as the maintenance and supply preparation it had received before it was invested, the character of its governor, and, perhaps most important of all, the competence of the attacker. As Marshal de la Feuillade demonstrated at Turin in 1706, any fool could mess up a siege of a Vauban fortress if he ignored the scientific principles of siegecraft, attacked the strongest point rather than the weakest, and relied on mass assaults with infantry rather than a systematic approach with sappers and miners. Vauban called such reckless assaults attacks '*à la Coehoorn*', since the great Dutch engineer often found a place for them in his sieges; but the difference was that Menno van Coehoorn knew exactly how to prepare and time them correctly, and his personal flair meant he could normally use them to good effect. Not even the strongest fortress was exempt from capture by such an expert, providing he could call upon the necessary logistic basis for his sieges.

Vauban fully recognized (quoting Jean l'Hoste's writings in 1629) that any fortress could eventually be captured by a competent attacker, and it was only a matter of calculating the number of days it could last out. Ideally a relief army should be sent to the rescue within that time; but more normally it could not be. By holding out for as long as possible the garrison could usually hope to do little more than inflict casualties and logistic expenditure upon the attacker so that his ability to mount further sieges later in the year would be reduced. This may not sound very glorious, but on numerous occasions it did mean that only one or two sieges could be mounted in each campaigning season. Thus the spirited three-month French defence of Landau in 1702 and then, after its

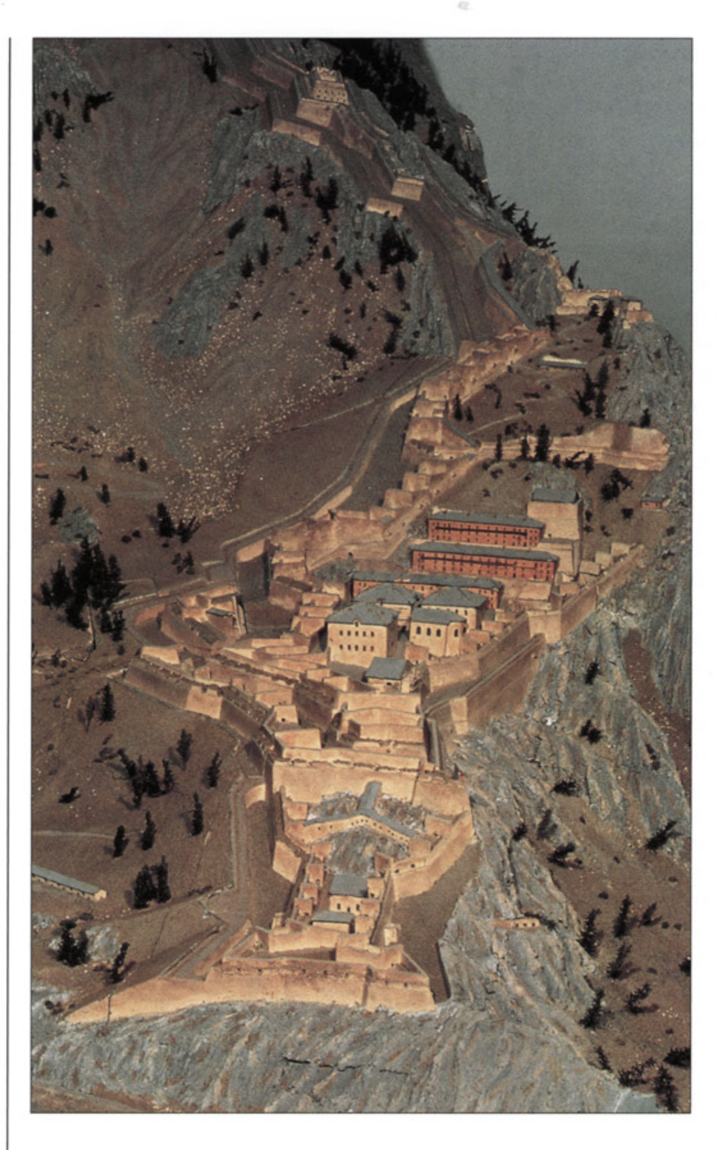


RIGHT Plan of Dunkirk in 1712, including Vauban's fortified jetties, the 'Risban' and other outlying positions, all built on shifting sandbanks below the high-tide line. It cannot be stressed enough that Vauban was as sure-footed in building fortifications at sea (or indeed in freshwater) as he was on land. (Nikolai Bogdanovic Collection)

recapture, their two-and-a-half-month defence of the same place in 1704, both had this effect, as did Mantua's resistance for over a year in 1701–02. Such episodes could powerfully reduce an attacker's progress to a snail's pace and give plenty of time to the diplomats to re-shape the strategic alignment of the European states without losing vast tracts of territory. In fact it was probably the diplomats who did more than anyone else to change the ownership of fortresses, and many were the Vauban works that were given to the enemy on account of treaties.

Before we leave the operational history of Vauban's fortifications we should pause to consider three special cases. The first is the role of fortresses in mountainous areas, where logistics are notoriously difficult for an attacker and communications are narrowly channelled along a few valleys that can be blocked relatively cheaply by fortifications placed at predictable crossroads. In the case of the Alps the main route from France to Turin ran up the river Durance to the Mont Genèvre pass and then to the Po valley down either the river Dora via Exilles and Susa, or the river Chisone a little further south via Fenestrelle. For the French this route was very easily blocked by building a large fortress at Briançon on the upper Durance, which was much improved by Vauban, although they eventually found it impossible to hang on to their three forts on the Piedmontese side of the watershed. Further south was the Col de Larche leading from the upper Ubaye to the Stura di Demonte, down to Cuneo on the Italian side. In this case Vauban built Fort St Vincent on the direct road; Mont Dauphin on the route towards Briançon, Seyne les Alpes on the road south, and he also modernized Chateau Queyras in the Guil valley. Finally the northern route into Italy from Grenoble up the Isère to the Little St Bernard was blocked by the French Fort Barraux, which Vauban modernized, and the nearby Savoyard citadel of Montmélian, which the French captured twice, only to destroy it in 1703. Thus every route was well barricaded, and in the later years of Louis XIV's reign the permanent barricades were reinforced by a number of entrenched camps. The result was a very robust system of fortification that provided a screen behind which French commanders could manoeuvre from one valley to the next during most of the second half of the War of Spanish Succession, to stymie each and every enemy thrust in good time.

Secondly, the defence of naval bases by coastal fortifications demanded a very different approach, since they were usually too far apart for the density of mutual support that was the norm on the Belgian frontier, and much more open to surprise attack from almost any direction than was the case in the Alpine valleys. By way of compensation the scale of attack to be expected from the sea was normally much smaller than on the landward frontiers, whether it was a matter of ships bombarding fortifications or soldiers and guns disembarking to conduct a conventional siege. In Vauban's time the techniques for large-scale amphibious landings were at a very elementary stage of development, and it must be said that the British record between 1793 and 1815 was still pretty patchy and uninspiring. All Vauban had to do, therefore, was to make sure that every naval base was properly fortified, albeit not necessarily to the same high standard as was required on the Belgian or Rhenish frontiers. Only the bombardment of civilians was a potentially devastating form of attack from the sea, and the intensive mortaring of Le Havre in July 1694 was particularly disturbing to Vauban, who immediately devised some complex drills to limit the damage on future occasions. The only other really major threat to his naval bases came when an enemy land army was close enough to march up in the normal way to conduct a siege, as Marlborough did successfully at Ostend in 1706 and the Austro-Piedmontese did unsuccessfully at Toulon in the following year. The same threat always hung over the corsair base of Dunkirk, which was very much in the front line of Vauban's *Pré Carré*, and to a lesser extent the same was also true of Gravelines. Moving only slightly further to the rear, however, it seems



ABOVE *Plan relief* of Fenestrelle, a fortress that was built by Vauban on the 'Italian' side of the Alps, and then passed back to Savoy by treaty. Note how the steep cliffs allow the fortress builder to dispense with the normal outworks. (Christian Carlet at the Musée des Plans Reliefs)

remarkable that neither Calais nor Boulogne, although both were seriously fortified, ever really came under serious attack in his era.

Thirdly, we must remember that many fortifications had a counter-insurgency role, at a time when the king was attempting to impose an unprecedented degree of regressive taxation, religious orthodoxy, and generally authoritarian control upon his subjects. He did not appear to be sensitive to the fact that his hard-line policies inevitably provoked many honest citizens to slip over the edge of conformity into subversion, and of course one of the most famous and gifted of these would eventually be none other than Marshal Sebastien Le Prestre de Vauban himself. It is therefore highly paradoxical that Vauban's lifework consisted in building well-defended barracks in many parts of France, from which well-armed garrisons might sally forth to persecute dissidents at any time, or even bombard them with heavy cannons. Admittedly he built very few fortifications in the Cévennes, where civil war raged at its murderously highest intensity, but some of his constructions were still notoriously hated by the local populations. At Bordeaux the royal citadel ('Château Trompette') of 1660 was specifically built to control the town, and Vauban later flattened some popular suburbs to clear the glacis. Adding insult to injury this fortification was adorned with exceptionally rich ornamentation, and the *plan relief* that was made of it was particularly lavish, thereby underlining the impression that it was 'a toy of princes' rather than a serious defence against external threats. Buildings of this type (not least at Marseille) planted a deep and long-standing association of royal fortifications with naked oppression and the 'embastillement' of the population, which would famously erupt with disastrous results in Paris on 14 July 1789.[13]

[13] The word 'bastille' originated in the medieval 'bastides' or fortified towns in south-west France, and was later applied to a number of other fortifications, e.g. the dominating fort on the Bastille hill overlooking the city of Grenoble.

Principles of defence and features of fortress design

When cannon became the primary weapon for the attack on fortresses in the 15th century, the whole shape of fortress architecture underwent a radical change. Instead of high masonry walls from which missiles could be dropped, the emphasis switched to low-lying gun batteries firing outwards, protected by thick earth banks and ditches up to 40ft deep. From the outside the attacker's artillery might be able to shoot at the defender's gun positions; but it would not have sight of the walls that his infantry would have to scale to get inside the place. It was only when his engineers had laboriously dug trenches forward to the lip of the counterscarp that he would get a clear shot across the main ditch to batter and breach those walls. The walls themselves might be faced with masonry, or they might not, but in either case their main strength would lie in the earth and rubble that was piled up behind their front face, to absorb cannon balls.



ABOVE Layout of Vauban's gatehouse and bridges at Tournai. Note his use of *orillons* in the flanks of the bastions, and a *tenaille* in front of the curtain wall. The trees planted on the rampart provided a reserve of timber that could be converted into palisades or firewood in moments of crisis. (Christian Carlet at the Musée des Plans Reliefs)

For close-in defence the fortress walls no longer had round medieval towers at their corners, but angular bastions. These were mathematically designed to allow musketry and grapeshot to reach every part of the ditch, thereby eliminating any dead angles where an intrepid storming party might be safe from fire while it attempted an escalade. The flanks of each bastion would mount cannon to sweep not only across the front face of the curtain wall, but also the flank and face of the next bastion. Each bastion thus depended on its neighbouring bastions for protection, in a layout of interlocking fields of fire.

All this was already commonplace many years before Vauban was born. In fact it had gone one stage further, and had turned into a complex mathematical exercise in which competing engineers presented ever more complex 'systems'



LEFT *Plan relief* of Vauban's citadel at Lille – one of his earliest works, of which he was especially proud. It is lavishly furnished with wet ditches, *tenailles*, ravelins and counterguards which all add depth to the defence; but of particular interest is the extra 'skin of the onion' that Vauban has added outside the normal covered way, in the shape of at least a partial second covered way. Also note the road coming in through the outworks from the main city at 'two o'clock' on the picture (actually the south-east), which may still be followed with profit today. (Christian Carlet at the Musée des Plans Reliefs)



RIGHT The counterguard covering the bastion just to the left (south) of the road into the Lille citadel. In effect it doubles the number of masonry walls that an attacker would have to beat down before making a decisive breach. In Vauban's day, of course, the ditches would have been filled with water to make the attacker's progress all the more difficult. (Paddy Griffith)

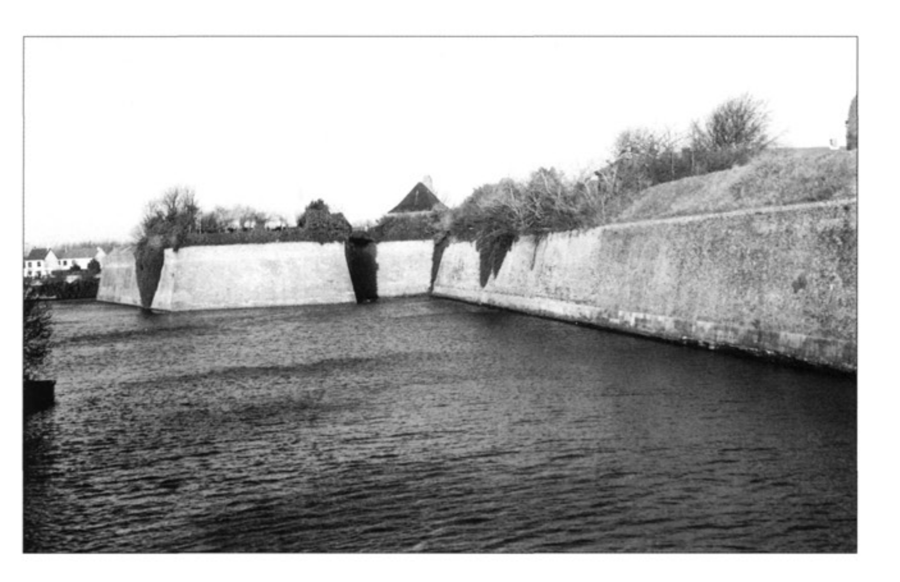
in treatises and manuals. These often seemed to stray far beyond the bounds of the practicable or the affordable, so that when Vauban arrived on the scene he found that his task was more a matter of choosing the best ideas from what already existed, rather than originating new ones of his own.

By the 1660s there were several different theories for how each point of detail should be resolved. For example a bastion might have an acute angle, a right angle, or an obtuse angle at its point, and various advantages and disadvantages were claimed for each. Unless there were peculiarities of the terrain that demanded special treatment, Vauban tended to follow the designs of his predecessor Count Blaise de Pagan, who opted for either a right angle or perhaps an only slightly more acute angle. The flanks of the bastion might be either straight or concave (in an '*orillon*'), and Vauban appeared to have no particular preference between the two. He did at least normally avoid some of the more complex systems for banking two storeys of guns into the flank, or putting them in casemates. When it came to designing the open top of the bastion he was happy to ring all the changes, in different times and places, ranging from a clear and open gun platform to various arrangements of banks and retrenchments, including a full redoubt (or 'cavalier') on top of the work, all the way to bastioned towers or detached earthworks ('counterguards') which followed the outer line of the bastion as a protection in front of it.

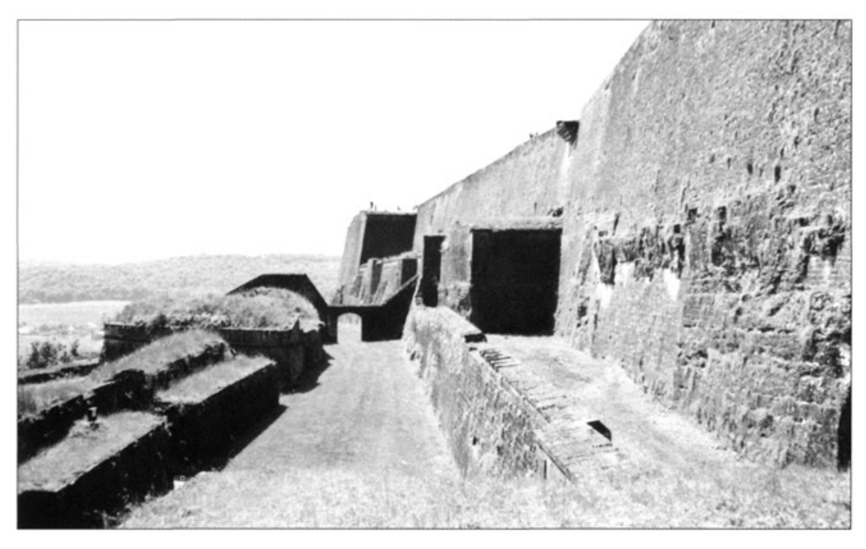
Then again the role of infantry in the defence might be envisaged in several different ways. All authorities agreed that infantry should man the covered way on the lip of the counterscarp which, unless there was a second covered way or detached outworks further forward, represented the most advanced defensive line. Even if the musketry of this infantry was seen as secondary to the firepower of the artillery sited further to the rear, it was important to have a strong force of lookouts and sentries guarding the line. More controversial was the role of infantry in defending the main wall, for which a number of different locations were on offer. In the first place there could be a *fausse-braye* – a line of breastworks at the foot of the wall, or in the ditch itself. Instead of this Vauban often preferred to have a free-standing *tenaille* in front of his curtain walls, and was less keen on siting it immediately next to the wall itself. Sometimes he would have an infantry walkway (*chemin de rondes*) along the top of the wall's masonry facing or even half way up it; but more normally he would keep footsoldiers out of the front line altogether and hidden behind the earth ramparts or in casemates behind them, ready to counter-attack any storming force.



BELOW Müller's 1746 plan of Vauban's citadel at Lille, showing the double covered way. (Charles Blackwood)



LEFT *Orillon* set into the flank of a bastion at the north-west corner of the fortress at Gravelines. (Paddy Griffith)



LEFT The east wall of the Spanish fortifications of Montmédy, showing an infantry rampart or *fausse-braye* at the foot of the main scarp on the right, and a covered way on the left. Vauban generally preferred to transfer the infantry rampart to either a *tenaille* further forward, or to a *chemin des rondes* at the top of the masonry scarp; but in this case he tolerated the arrangement that was already in place – especially because the site was so restricted and steep. (Charles Blackwood)

If they were lucky, infantry lookouts might be provided with masonry sentry boxes (*guérites* or *echanguettes*), which might sometimes be elaborately decorated with heraldic devices and other ornamentations. More prosaically, as at Neuf Brisach, there might be only a decorated masonry base upon which a timber sentry box (or more prosaically still, a toilet overlooking a wet ditch) could be mounted. Timber was always in great demand by any garrison, with many diverse uses ranging from firewood to building materials, which explains why ramparts were so often planted with trees that could be cut down in the event of a siege. Of particular importance was the need to maintain palisades of pointed stakes in front of covered ways or in dry ditches, to break up assaulting infantry formations in the same role as barbed wire in modern warfare. Equally '*fraises*' or storm poles would be planted horizontally into the masonry walls of a scarp to deter escalades. Neither of these important defensive features would last for many years if left unattended, and their condition was a frequent subject in Vauban's fortress inspection reports. There was a constant need to review and renew them if a fortress was to be considered fully battle-worthy, and of course we can no longer find any examples surviving into modern times. To that extent there is no fortress that we can visit today which is in the state that Vauban would have wished to see it.


Serving the guns

LEFT **Serving the guns**
This illustration shows a coastal fortification defending a harbour. The guns were moved around inclines into position; note the large wheels (typical of field guns, as opposed to fortress carriage designs). The walls of the powder magazine have been cut away here; the barrels are stored on planks above a raised wooden floor. To the left of the magazine lies a furnace, for heating red-hot shot for use against ships. To the left of this mortars are being fired. The inset illustration shows one of Vauban's designs for a two-storey powder magazine; the design of its ventilation slits prevented incendiary material entering the magazine from outside.

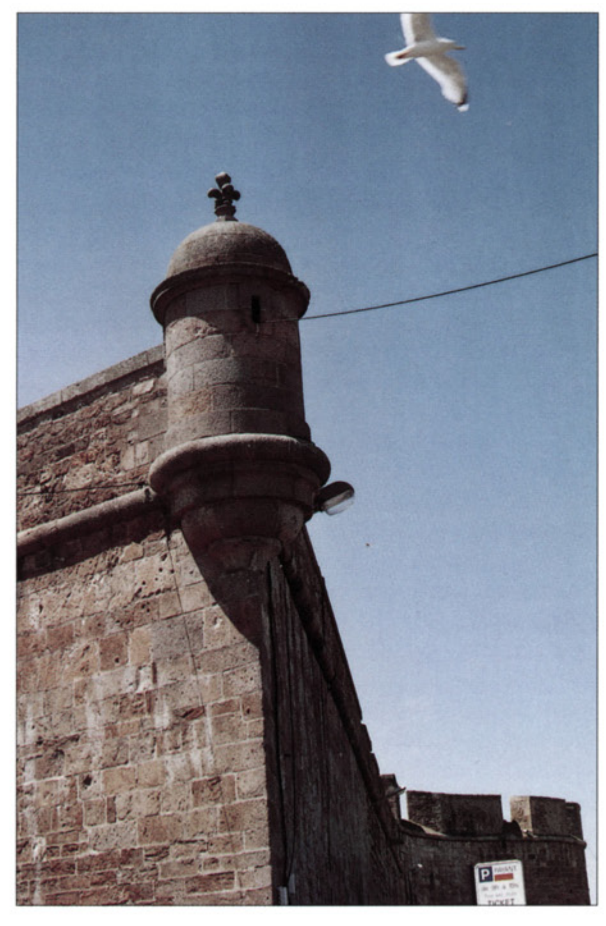


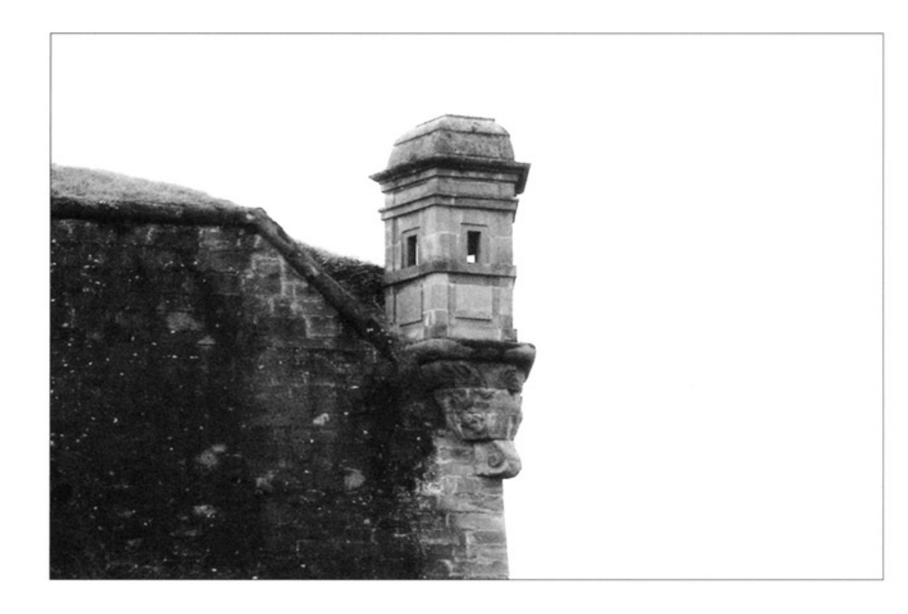
LEFT Permanent masonry emplacement for a semi-permanent wooden sentry box at Neuf Brisach. (Paddy Griffith)

BELOW Masonry sentry box (*echanguette* or *guérite*) at the angle of a bastion in Vauban's town *enceinte* at St Malo. (Paddy Griffith)

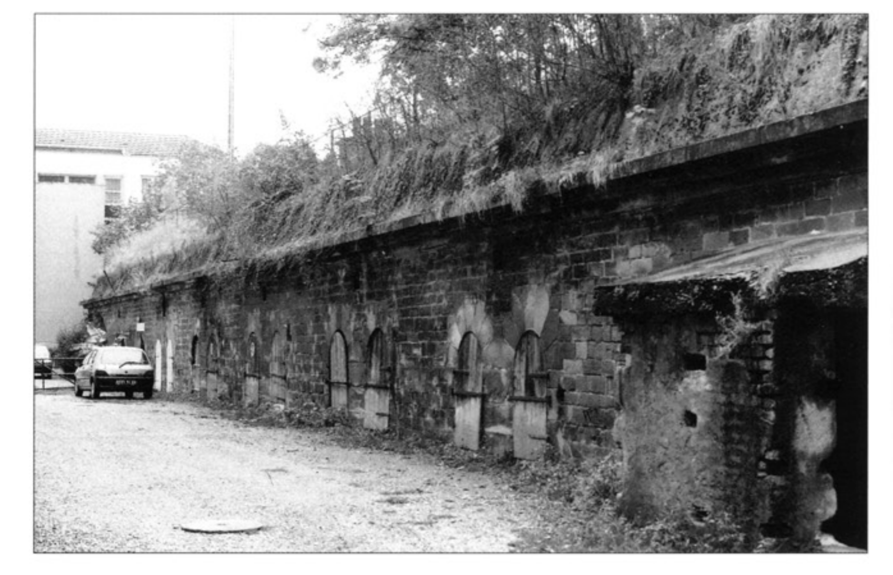
The artillery of a fortress would normally have two sites. The first was on the ramparts from where it could fire outwards against a besieger's trenches and batteries, or into the fortress ditches if attackers managed to penetrate that far. Depending on the development of the enemy's attack, the guns might be moved around from one wall to another, or from advanced ravelins back into the main line of defence. Secondly, artillery would have shelters in casemates or elsewhere in the interior of the works, in case the ramparts were swept by a volume of fire that was too heavy to bear. In order to preserve his guns from destruction, a defender would try to strike them down from exposed into covered positions until the moment came to concentrate them at a key point in a moment of crisis, for example when a breach was stormed. Thus the guns had to be mobile and flexible within the fortifications, which meant that the fortress designer had to ensure there were sufficient ramps and inclined planes to facilitate their movements. As part of this, various sally ports, tunnels and 'secret passages' would be provided through the ramparts and *tenailles*, to allow the garrison to move around the defences while remaining under cover from enemy fire.

Vauban's favoured 'bastioned towers' represented a special case for artillery, since they were one of the few occasions on which he planned to fire guns from casemates. Normally he tried to avoid this, not only because they were more expensive to build, but also because in such an enclosed space the smoke soon made it very difficult for gunners to operate. Yet the





RIGHT Masonry sentry box at Belfort. (Richard Madder)



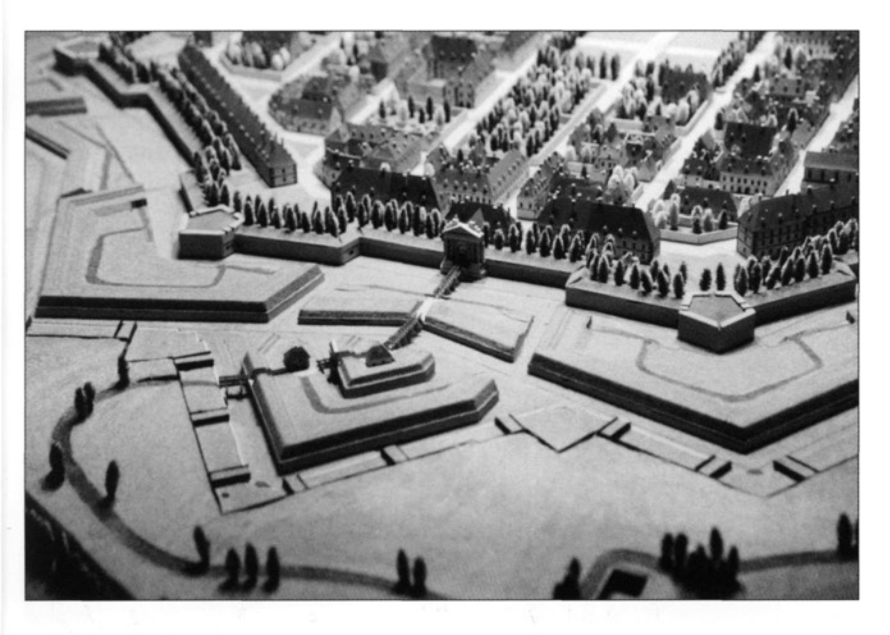
RIGHT The entrances to bombproof casemates built into the rear wall of the main rampart at Neuf Brisach. These protected spaces would have been intended for the storage of supplies or as shelters for troops and guns. (Paddy Griffith)

idea of a bastioned tower was to prolong resistance for longer than was possible for a normal bastion. It needed special arrangements because it was supposed to act as a heavily armed and self-sufficient citadel in its own right – a fact that helps explain why no conventional citadel was included in Neuf Brisach, apart from the eight bastioned towers.

The main source of depth in Vauban's defences nevertheless derived from a variety of ravelins, counterguards, hornworks, second covered ways, and other obstacles placed in a screening role in front of the baseline bastioned trace, as extra 'layers of the onion'. The sheer scale and complexity of these can often be as awesome and confusing to the modern tourist as they were supposed to be to a 17th-century besieging army. Sometimes they extended over very wide areas of country, compelling any attacker to open his first parallel far from his ultimate target, thereby forcing him to spend longer sapping forward, and so prolonging the time needed to complete the siege. In Vauban's later years some of his contemporaries were pushing this principle even further than he would normally do himself, with small, cheap and cheerful, triangular, earth *lunettes* being excavated at the last moment in positions ahead of the covered way.

In suitable ground the glacis might also be honeycombed with subterranean counter-mine galleries, arranged in an asymmetrical, irregular pattern to prevent an attacker working out their locations. These galleries would have their entrances on the fortress side of the covered way or of a ravelin, and would lead forward to prepared chambers which could be filled quickly with gunpowder and then blown, when the besieging forces came to dig their approach works over the relevant spot.

Much would obviously depend upon the type of soil, the level of the water table, the intrusion of contours or rocky outcrops, or the degree to which the entire fortress could be overlooked from higher ground. Vauban was a great expert in taming all these aspects, and would even express preferences for one type of grass over another, to bind together the soil on a glacis, or for the type of trees to plant along the line of a parapet. If need arose, as at Villefranche de Confluent in the eastern Pyrenees, when a fortress was stuck in a valley surrounded by beetling crags, he would be ready to take command of the high ground by throwing out a detached fort some hundreds of feet above the town (i.e. Fort Libéria, built 1680). Ideally, however, a 'green field site' such as Neuf Brisach would be entirely flat, with plenty of water available to fill the ditches or to make wider inundations. Fort Nieulay just outside Calais protected a lake where shipping might assemble and the whole area was criss-crossed with canals. In fact one of them ran straight through the centre of Vauban's work, and had to be fitted with special grilles for its entrance and exit.



A modern *plan relief* of Neuf Brisach (in the town's museum), clearly showing the famous bastioned towers and redoubted ravelins that are supposedly the hallmarks of Vauban's alleged 'third system'. (Charles Blackwood)



This picture shows a detached redoubt inside a ravelin at Neuf Brisach – one of the key features of Vauban's innovative design of this fortress. (Charles Blackwood)

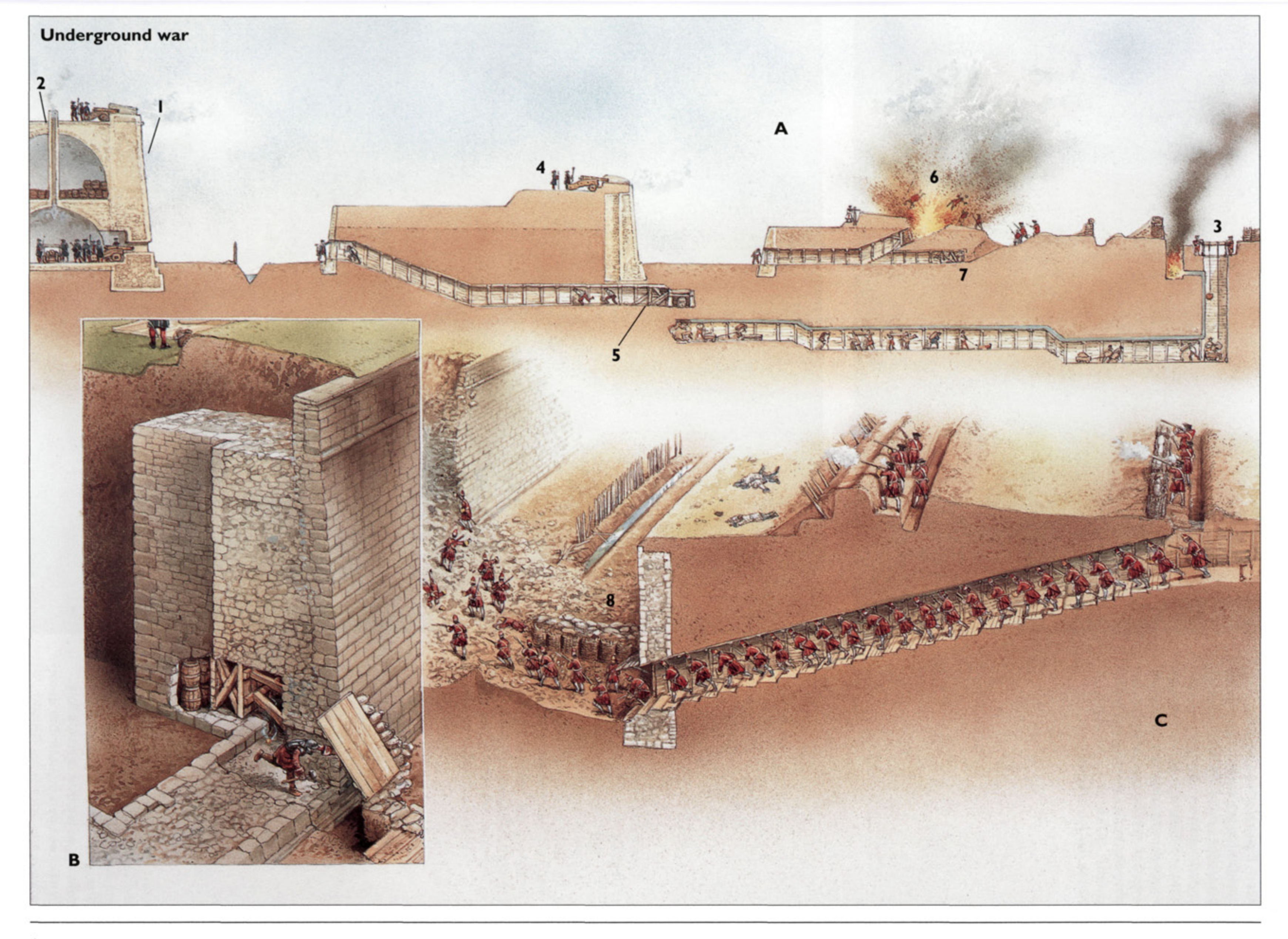
RIGHT **Underground war**

(A) The top illustration shows **(1)** a three-tier bastioned tower of the defenders with casemated guns at ground level ready to sweep the ditch in the event of attackers breaching the defences. Note **(2)** the ventilation tower for the guns to prevent the build-up of smoke. The attackers have begun digging a deep mine just outside the glacis **(3)**, heading for the defenders' ravelin **(4)**. Ventilation of the shaft is conducted by means of a burning fire in a countershaft. The shaft has been dug at counter-angles to prevent back-blast when it is blown. The defenders, however, have dug a counter-mine gallery **(5)**, which is packed with gunpowder and about to be ignited. Meanwhile, the defenders have just exploded another counter-mine dug underneath the glacis **(6)**, killing the attacking troops sapping towards it. The site of a previously exploded counter-mine can also be seen **(7)**. **(B)** This inset shows a mine about to be exploded beneath a ravelin wall. Note the cuirass armour worn by the miner. **(C)** This illustration shows a descending underground passage leading to the dry ditch and a breach in the wall, which the attacking troops are aiming to exploit. Note the gabions (wicker baskets) at the mouth of the tunnel **(8)**, to protect against flanking fire from the defenders.

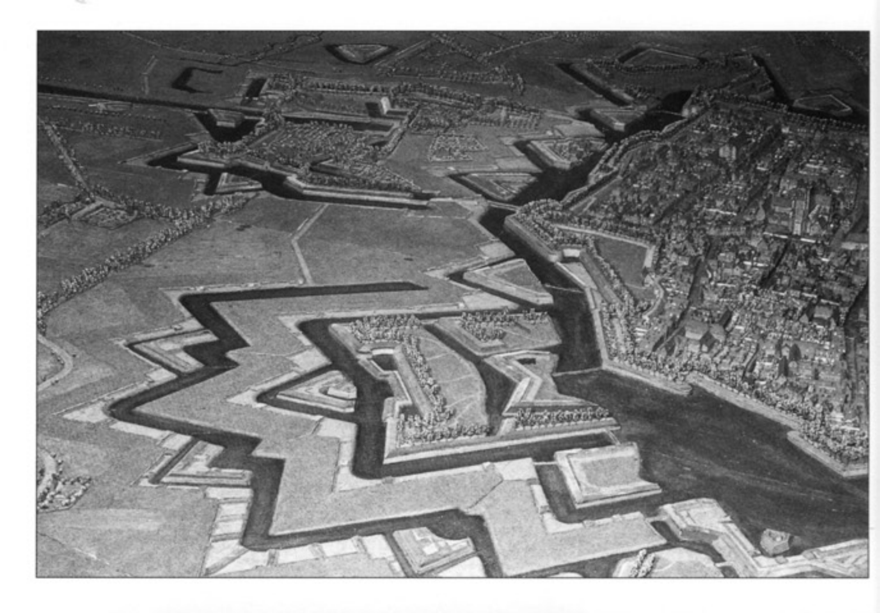


RIGHT Vauban's bastioned tower and masonry sentry box at Belfort, showing the apertures for cannon on the ramparts (which would not have had a tiled roof in the 1600s). There were also casemates for cannon to sweep the ditch at ground level – a feature common to all of his bastioned towers, even though no one else would see fit to copy this particular configuration. Casemated cannon towers or *caponnières* would become increasingly popular during the 18th and 19th centuries, but never in quite the way Vauban had expected. (Charles Blackwood)

BELOW The contrast between ancient and modern: one of Vauban's ravelins (left) protecting the medieval walls of Bergues. (Paddy Griffith)


Underground war
1
2
3
4
5
6
7
8
A
B
C

RIGHT *Plan relief* of a typically complex Vauban hornwork at Ypres, protecting one of the wide obtuse-angled bastions of the town *enceinte*. Note that an attacker would have to cross two covered ways and at least four water obstacles before reaching the main rampart. (Christian Carlet at the Musée des Plans Reliefs)



RIGHT Tunnel through a *tenaille* at the Landau citadel, to permit free movement of the defenders and their guns from one part of the defences to another. It would have been closed by a stout timber door when not in use. (Paddy Griffith)



LEFT *Plan relief* of Gravelines showing the small citadel in the left foreground, with rounded medieval towers facing into the town. The detached building on the left inside the citadel is the powder magazine (see the photo below). (Christian Carlet at the Musée des Plans Reliefs)



LEFT The powder magazine at Gravelines, which is built to Vauban's standard plan. The apparently fragile slate roof conceals strong, bombproof, masonry vaulting, and the narrow 'window' slits are filled by cunning masonry blocks around which air can circulate but through which sparks from the outside cannot pass. (Paddy Griffith)

Despite his readiness to adapt pragmatically to the local terrain and conditions, Vauban did still rely on a number of standardized features that appear time and time again in his fortresses, regardless of whether they were located in the mountains or on the plain. Most obvious to the soldiers of the garrison would be his basic design for a three-storey, 144-man barrack block, arranged around a central staircase. On each floor there would be four rooms each containing four beds, each bed sleeping three men – although they would notionally use it for eight hours each, in shifts. Any number of blocks, or staircases, could be built side by side, to provide accommodation for garrisons of any multiple of 144 men.

Normally the barracks would be built just behind and parallel to sections of the curtain wall, which meant that the troops lived as near as possible to their work. This represented a radical departure from the normal practice before Vauban's time, when the soldiers had been billeted in civilian dwellings all over the town, making them difficult to assemble when needed, and open to all sorts of temptations and decadences that were corrosive to both discipline and health. An army that lived in barracks, by contrast, could be counted far more easily. It was all present and correct at any given moment, under the eye of its NCOs and officers, even if one third of it was always theoretically supposed to

RIGHT *Plan relief* of the barracks at Belle-Isle. The mass building of barracks during Vauban's time meant that the troops were decreasingly billeted on the civilian population, and thus became more 'militarized'. (Christian Carlet at the Musée des Plans Reliefs)



BELOW The entrance to a counter-mine gallery at Landau, lurking at the rear of a ravelin in the defences of the citadel. Admittedly this one was built in 1740–42, but the general principle had been endorsed by Vauban, who had originally designed the Landau citadel, half a century earlier. (Paddy Griffith)



be asleep. This embarrackment (*casernement*) of Louis XIV's army, more than any other factor outside the realms of high finance, surely lay at the very heart of the whole 'military revolution' of the 17th century. And naturally it was the great expansion of fortress building during the same era that went a very long way towards making the system general.

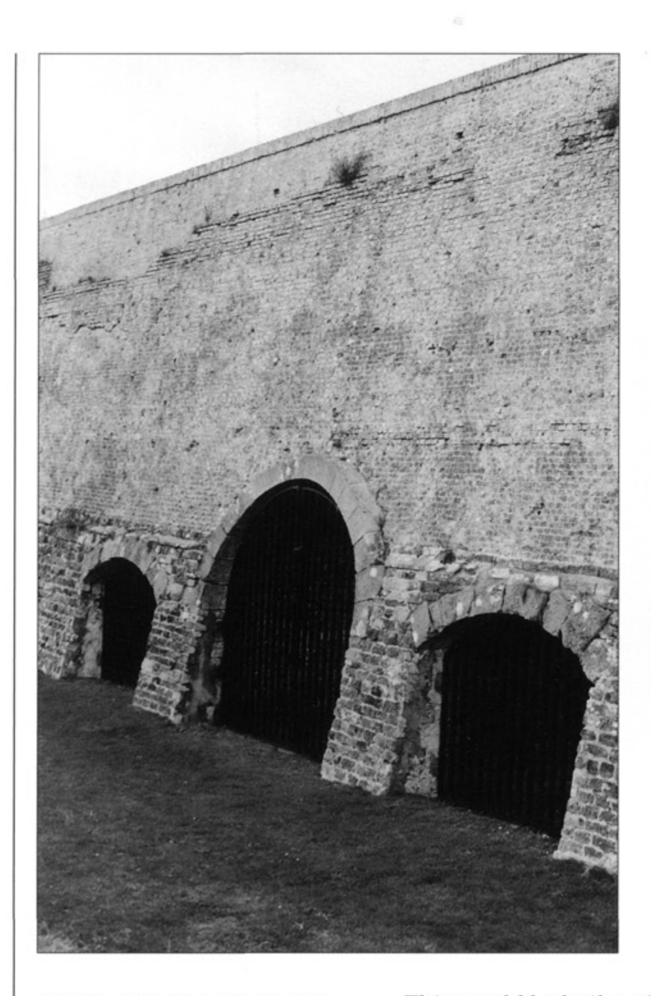
Embarrackment could not, however, ensure the total de-civilianization of the army. As long as troops found themselves in a static garrison that was not immediately involved in siege operations, they would surely find many ways to mingle with the local population. Women and children might well be invited to reside in the barracks, and would be adopted semi-formally as 'part of the unit' even though not always directly on the payroll. The male orphans of fallen soldiers (or indeed children of many other origins) could be signed up officially as paid '*enfants de troupe*' serving as junior drummers or kitchen boys who would later evolve into full-grown musketeers or gunners. Conversely the old soldiers would often take part-time employment in the town to supplement their wages, and a certain proportion of their weekly routine would be officially written off to this type of activity. In these circumstances it would certainly be a disaster if the unit should be posted to some other garrison, since this would rip families asunder and deprive all concerned of both their comforts and a significant part of their incomes.

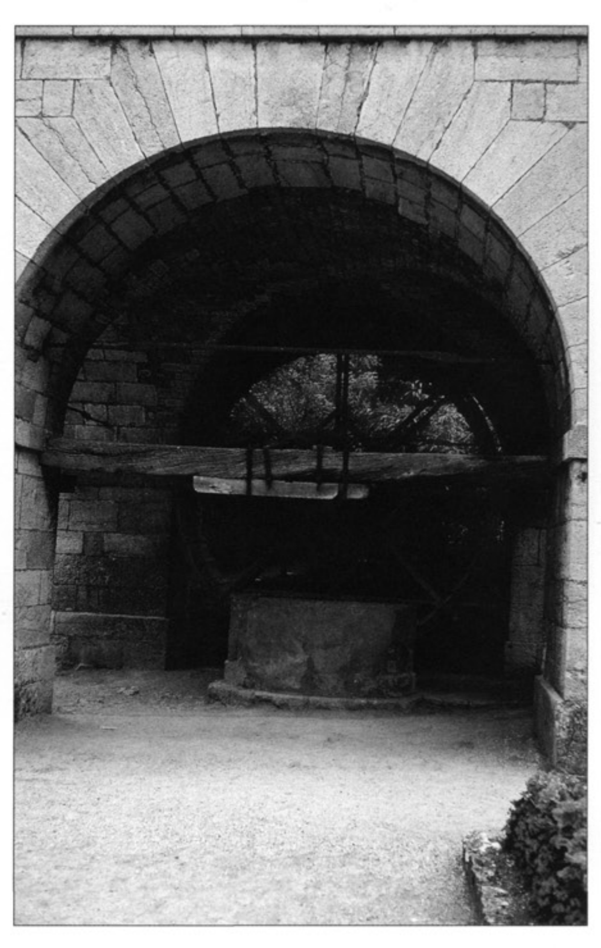
ABOVE *Plan relief* of Vauban's Fort Nieulay, at a junction of canals (today mostly drained) about a mile west of the citadel in Calais. Note the canal running through the fort itself, also the lines of fieldworks, which may still be seen on the ground, to protect the canals outside the fort. (Christian Carlet at the Musée des Plans Reliefs)



LEFT Site of the original canal in the centre of Fort Nieulay, Calais. (Paddy Griffith)

Outside the barracks, in the centre of the fortified town, Vauban liked to have a large parade ground where the garrison could assemble and drill. Next to it would be the central administrative buildings – assuming they weren't removed to a citadel – and a church. Whenever he planned a new town, Vauban would typically include a solidly built church near its centre, as a focus for the spiritual life of the population who, in accordance with royal doctrine, would naturally all be Catholic. It would be built in a sober style and would incorporate an excellent lookout post at the top of the tower, which might have a military as well as a spiritual utility. Somewhere nearby, and once again preferably in a citadel, would be the central powder magazine.





TOP LEFT Barred gates in the main rampart of Fort Nieulay, Calais, through which the canal used to run. (Paddy Griffith)

TOP RIGHT A casemated well in the citadel of Besançon. Obviously the water supply was a matter of major concern to any garrison, and Vauban always paid great attention to it. (Paddy Griffith)

This would be built to Vauban's standard single-storey design, which from the exterior seemed to be highly vulnerable to bombs crashing through the slated or tiled roof, but which from the inside turned out to be far more robust than that. It would contain a strong, masonry-vaulted roof that was highly resistant to bombardment. Inside it the powder barrels were stored above ground level on timber planking covering a floor of stones and gravel, to ensure dryness but without the risk of sparks being struck off the stones. Clever ventilation ducts in the side walls ensured that the powder was exposed to moving air but, once again, without the possibility of lighted material flying in from the outside

Marching out from the central parade ground, members of the garrison would pass through the main curtain wall via an elaborate ornamental gatehouse. The king's prestige was deemed to be intimately connected with the standard of decoration and heraldry displayed on these gates, and Vauban's correspondence is full of disputes over the level of expenditure that he might be allowed for them (normally he wanted to spend more, whereas Louvois wanted to spend less). At least one modern historian of architecture, Sir Reginald Blomfield, has sided strongly with Louvois on the grounds that Vauban was merely a 'builder' devoid of aesthetic taste, so that any monies spent on his ideas of 'beautification' were simply being flushed down the drain. Others might feel entitled to disagree, and especially the 'Sun King' himself, who must surely have been gratified to find the visible symbols of his pomp and circumstance proliferating around his fortresses all over France. There is certainly no evidence to suggest that he regarded expenditure on prestige as in any sense less important than expenditure on security.

LEFT Outer gatehouse on the ravelin to the south-east of the citadel at Lille. This is far less lavishly ornamented than the main gatehouse on the inner wall, but still very nicely proportioned. It is unfortunate that, as in far too many other cases, the original drawbridge has been removed and the approaches filled in with a permanent roadway. (Paddy Griffith)



BELOW This gatehouse at Alt Brisach was one of the largest and most heavily ornamented of its era, although the multiple changes of ownership of the fortress meant that the heraldry (at three different levels directly above the gate) was liable to frequent alteration. Notice the rare attempt in modern times to preserve the original style of the timber bridge leading up to the gate. (Jeff Fletcher)

Each gatehouse would be furnished with a guardroom and perhaps musketry embrasures, as well as a drawbridge leading to a flimsy wooden bridge over the main ditch. In moments of crisis the drawbridge could be raised and the bridge destroyed with relative ease; and in any case the direction of the road was offset at an angle to each layer of the defences through which it passed, to limit the effects of both enfilade fires and direct storming. Quite often in modern times the wooden construction of the bridge has been rebuilt more solidly in masonry or earthworks, and the drawbridge itself replaced by a permanent bridge that lacks the tactical qualities of the original, but with the eye of faith the modern visitor can usually discern how strong the original arrangements must have been.

On the far side of the ditch, just before the covered way, there would be a barrier on the road and a relatively small detached guardroom, at which anyone passing in or out could be examined and granted free passage, or not. Once again this was a universal design used in all Vauban's fortresses, and it may be seen at all points of the 'hexagon'. It was not intended to be

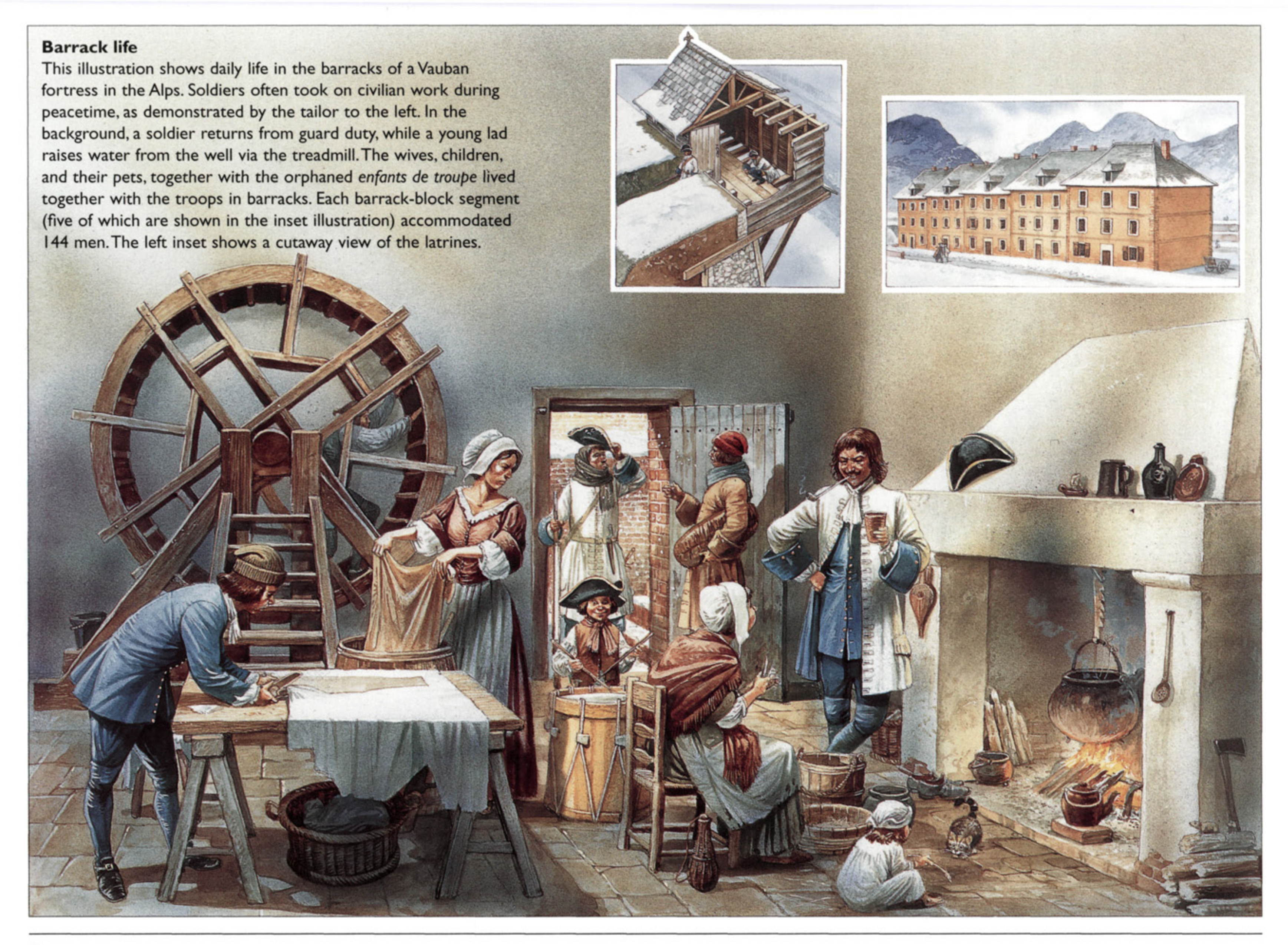
particularly resistant to heavy attack, but it still made a very useful building for day-to-day police purposes. Mention of the police reminds us that fortresses were not only strongpoints to ward off external attackers, but could also be used as strongholds to imprison criminals and other enemies of the state. Being enclosed spaces supervised by heavily armed garrisons, fortresses could accommodate quite large numbers of prisoners (including prisoners of war) at little additional expense to the king. What local jail or police station could possibly be more secure or better protected than a major fortress?



RIGHT A typical Vauban guardroom at the front gate of the Lille citadel, seen from the inside of the fort. Although he always varied the architectural styles of his fortresses according to the terrain and local conditions, Vauban very often used standard (or 'off the shelf') designs for specific features such as barrack blocks, powder magazines, and guardrooms. (Paddy Griffith)



RIGHT *Plan relief* of a standard Vauban guardroom on the covered way at Bayonne; in this case it is protected by a wall loopholed for musketry. Note also the infantry's *chemin des rondes* at the top of the masonry scarp, which is located below and in front of the gun positions on the main earthen parapet. (Christian Carlet at the Musée des Plans Reliefs)



Barrack life

This illustration shows daily life in the barracks of a Vauban fortress in the Alps. Soldiers often took on civilian work during peacetime, as demonstrated by the tailor to the left. In the background, a soldier returns from guard duty, while a young lad raises water from the well via the treadmill. The wives, children, and their pets, together with the orphaned *enfants de troupe* lived together with the troops in barracks. Each barrack-block segment (five of which are shown in the inset illustration) accommodated 144 men. The left inset shows a cutaway view of the latrines.

Aftermath

Vauban died in 1707 in the middle of the War of Spanish Succession, at a moment when the enemies of France were making their heaviest and most effective assault since Louis XIV came to the throne. In his lifetime Vauban had already proved many times that his art of attacking fortresses was hugely superior to anything that had come before; but now it was his art of building and defending fortresses that was coming into question, especially since the enemy had learned most of his novel techniques for the attack.

The answer was that although some individual fortresses might succumb quickly due to faulty provisioning, poor command, or other accidental influences, the overall strength of Vauban's barrier chain was triumphantly demonstrated during the remaining years of war up to the Treaty of Utrecht in 1713. Not only did his fortresses continue to out-perform the enemy at the tactical level, due to his superior designs and especially the high professionalism and skill of the French engineers whom he had instructed, but also the coherent strategic layout of his fortresses turned out to be a very major factor in the general shape of these campaigns. Equally his proposal to reinforce permanent fortifications with fieldworks turned out to be a very effective way to limit the mobility of the enemy's field army.

It is not too much to claim that Vauban laid down the whole 'book of rules' that French engineers would continue to follow for the next 150 years. His legacy was so comprehensive that they found it entered the very wiring of their brains, and was extremely difficult to shake off. Nor was this a mistake, since his general approach was based on common sense and many of his specific fortifications continued to serve France well through all the wars of the 18th century and the Napoleonic era. From time to time brave voices would be raised to suggest that some other way of doing things should be found – most notably Montalembert with his system of *caponnières* and casemated towers – but by and large such heresies failed to make a major impression. Most of the attempts to stray from Vauban's methods could credibly be dismissed safely, in the words of Professor Duffy, as 'more or less insane alternatives'.[14] Apart from anything else, many of the works that Vauban himself had planned still remained to be built or completed at the time of his death, so to that extent he left a very detailed programme of building to his successors which, in the absence of compelling technological change, they were often perfectly happy to carry out. For example, his suggestion that cheap iron cannon should be mass produced, in place of expensive bronze ones, was fully embraced by the authorities only as late as 1840, when the fortification of Paris (itself a Vauban project) demanded an enormous number of guns within a short space of time.

It would be only the dramatic change in armaments from the 1850s onwards that would demand a radical change in fortress design, even though a number of Vauban's works would acquit themselves well in the Franco-Prussian War of 1870–71. At first the main requirement was for much deeper 'defence in depth' than even he had envisaged, in view of the greatly increased range of rifled artillery. This was provided by building a cluster of detached forts all around each original Vauban fortress, at a distance of several miles from it. In the late 1870s it was General Serré de Rivières who carried out much of this work, although his fortifications were quickly made obsolete by the invention of high-explosive shells in the 1880s. Thereafter there was a

[14] *Siege Warfare*, Vol. II, p.157.

requirement to protect all key positions with either concrete or steel, and a new generation of designs began to appear in the years before 1914 which finally, and at very long last, can be said to have broken radically away from the spirit of Vauban. Even so, the works that he had built still continued to play a role since, although their earth ramparts were now far more vulnerable to shell fire than they had been in his time, they still offered much more protection than ordinary buildings (or their cellars). Thus the British Expeditionary Force of 1917 was happy to dig its tactical headquarters into Vauban's walls of Ypres, just as the Germans would choose his fortress of Le Quesnoy as a defensive position on 4 November the following year. Then again in 1940 a new BEF would base its defence of Calais precisely upon Vauban's citadel and 'Risban'; and so it went on. Even as late as 1968 the US Marines experienced great difficulty when they stormed the fortress of Hué in Vietnam, which French engineers had built in the early 19th century with 24 bastions inspired directly by Vauban's methods.



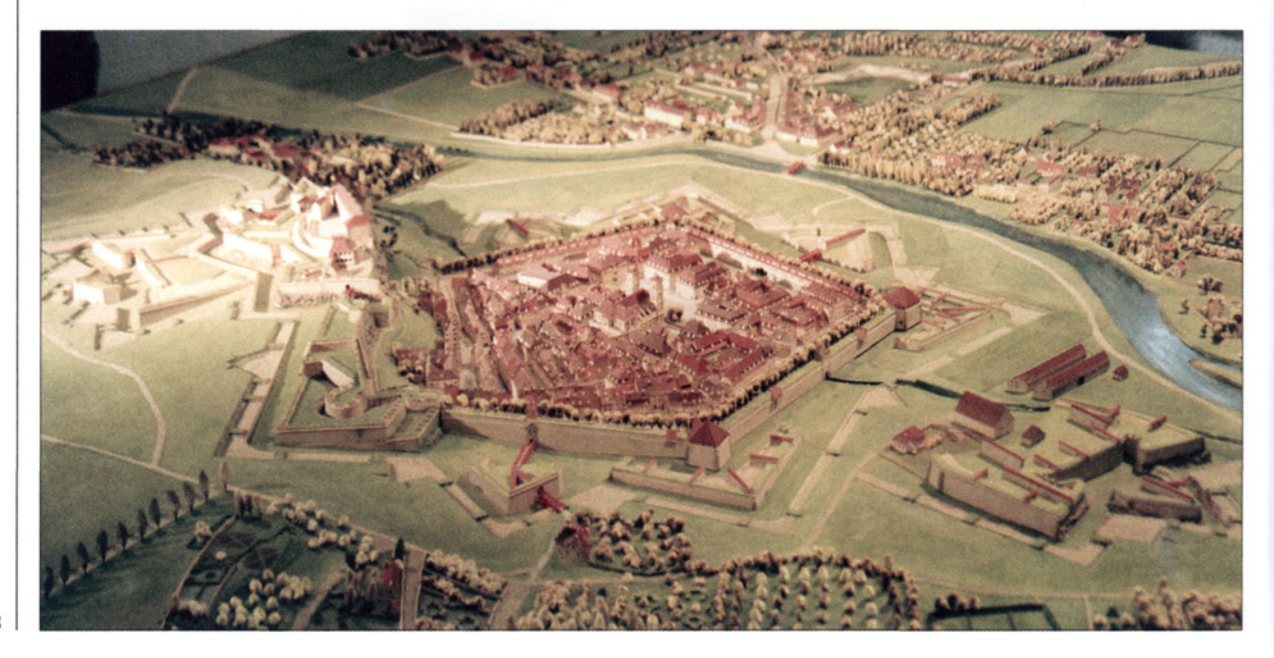
The northern gatehouse at Lauterbourg with the unmistakeable symbol of the 'Sun King' shining out as its crowning glory. The passage of time and the ravages of many wars and revolutions have made this particular symbol much less commonplace today than it was in, say, the 1680s. (Paddy Griffith)

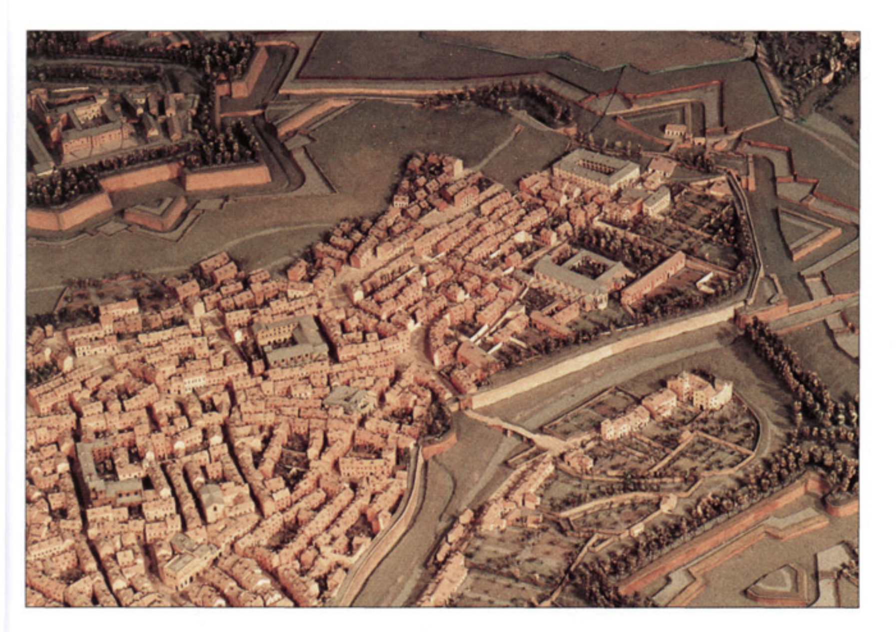
The sites today

It is a fortunate coincidence for the British reader that perhaps the most concentrated collection of surviving Vauban fortresses is to be found in the region of Calais – the closest and most accessible point of the French 'hexagon' to Albion's shores. A French reader might, however object that this is no coincidence at all, insofar as the Royal Navy always constituted one of the greatest threats that Vauban had to counter. It was his duty to fortify a long string of ports and anchorages all the way along the Atlantic coast from Spain to Holland, and it so happens that, among others, many of his works at Calais, Ambleteuse, and Gravelines are very well preserved today. The Royal Navy was, however, far from Vauban's only concern in this area, since the Spanish Netherlands (i.e. modern Belgium) was his most active theatre of war on land, bar none. Plenty of the disputed part of this territory is located within 75 miles of Calais, including Bergues, Ypres, and especially Lille – where the citadel was Vauban's first major creation and the centre of many of his later combinations. All six of the works mentioned above remain in reasonably good condition, and the visitor can also enjoy the added attraction of the magnificent breakaway gallery of 16 *plans reliefs* of northern towns which some naughty politician managed to spirit away from Paris to the Musée des Beaux Arts in central Lille in 1986.

Beyond the Calais and Lille areas there are very many Vauban fortifications that are still in excellent condition, ranging from the magnificent crags of Briançon to the perfect geometry of Neuf Brisach, and from Bellegarde and Mont-Louis perched high in the eastern Pyrenees to a dazzling series of small but perfectly formed coastal batteries guarding the maritime approaches to Bordeaux, Rochefort, Brest, and St Malo. The tourist may buy an official map showing the status of all these sites from the Institut Géographique National (IGN no. 907: *France, ports et citadels, musées militaires*), although rather disappointingly it fails to distinguish the personal work of Vauban from the

BELOW Modern *plan relief* of Belfort, showing Vauban's bastioned towers and covered way. (Charles Blackwood)





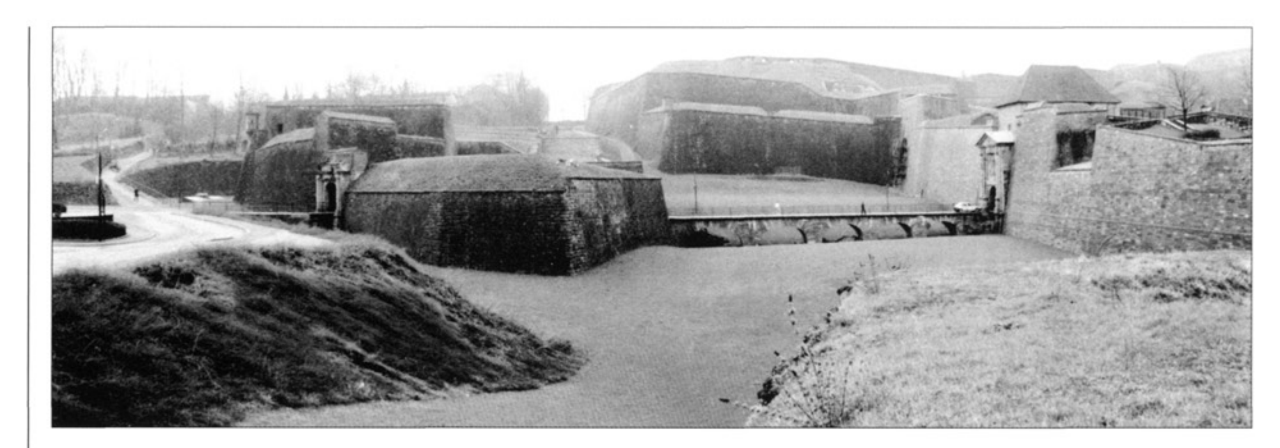
LEFT *Plan relief* of Vauban's town *enceinte* at Perpignan, showing the complex urban configurations that had to be fitted into his fortifications. The older citadel complex (to which Vauban added a barrack block) is at the top left of the picture. (Christian Carlet at the Musée des Plans Reliefs)



LEFT Three standardized guardrooms in the outer works at Bayonne: one on the ravelin and two facing each other on the hornwork behind. It is only a pity that the bridge connecting the two sites, and the next one back to the ornamental gate in the main wall, seem to have been demolished – presumably through fear of an imminent enemy attack. Note also the large earth ramparts against enfilade fire that have been erected on top of the bastions. (Christian Carlet at the Musée des Plans Reliefs)

other fortifications built in his era. It is also unfortunate that the IGN map has nothing to say about his works outside the 'hexagon', such as Landau in Germany, which was one of his most interesting conceptions. The citadel there has in fact been well preserved and is informatively interpreted by plaques to explain the purpose of each *tenaille, demi-lune* and counter-mine gallery, although unfortunately the whole thing is frustratingly concealed in a heavily wooded park and has an entire post-1960 university at its centre.

The university at Landau is just one example of the many diverse uses to which Vauban's fortresses have been put. More than a few of them are still in military hands today, doubtless because of their barrack accommodation rather than any continuing defensive properties. From as early as the 18th century some of them were also used as prisons or places or execution, with many British POW finding themselves detained in Verdun during the Napoleonic Wars, and many Belgian dissidents being killed in Sedan by the Germans in



ABOVE The frontage of the west gate at Belfort, showing Vauban's outworks. (Charles Blackwood)

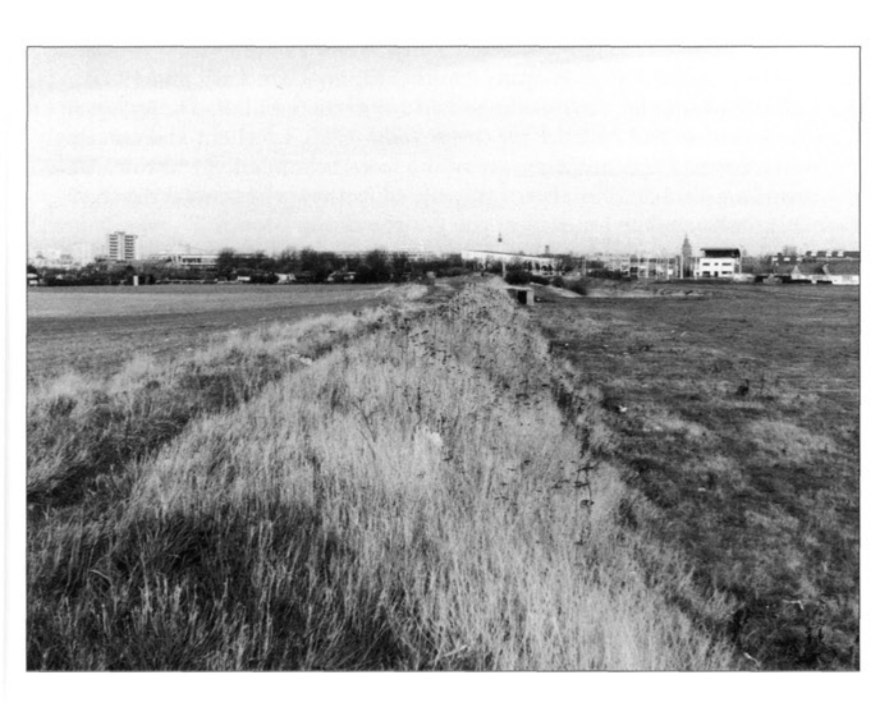
World War I. Then again, many of these fortresses today house museums, art galleries, libraries, and even the occasional zoo. Fortress ditches seem to be a favoured site for circuit training or assault courses, while their ramparts can often provide tourist promenades, picnic places and popular viewpoints over the surrounding countryside.

As one would expect, of course, very many of Vauban's works have not survived in anything like a pristine state. Some were never built in the way he had planned them, and many others were demolished in his own lifetime, or during the following century, due to the iron necessities of statecraft and war (including Joseph II's mass slighting of the Belgian fortresses in 1781–82). Equally, many of his works were built over by later engineers modernizing the defences of the same sites; for example the outworks to the Belfort citadel are very hard to interpret due to Haxo's additions in the mid-19th century. The Germans had also converted Metz into the biggest fortress in the world by 1914, with Strasbourg not very far behind, at the expense of quite a bit of Vauban's building. Then after 1918 very many of his works were overlaid with the steel domes and concrete casemates of the Maginot system, or by the brutally massive blockhouses of the Organisation Todt. Other Vauban sites survived intact for more than two centuries, only to become battlefields in the age of high explosives. The massive shelling of Liège in 1914, Verdun in 1916 and Ypres in 1917 are well known; but rather less familiar are the fates of Armentières, Arras, Bouchain, Le Quesnoy, Mons, Nieuport, and Péronne in the same war, or Bouchain (again), Boulogne, Brest, Calais, Cherbourg, Dunkirk, Fenestrelle, Metz, and Sedan in 1940–45. All of these were Vauban fortresses and all of them were battered in the fighting, although it is remarkable how many of them, like so many other features of these battlefields, were lovingly restored to something close to their original form once peace returned. One may still gain a very fair idea of what Vauban intended at a majority of these sites.

Far more devastating than world wars has been the universal expansion of urban building during the past two centuries. Civic renewal and the creation of roads, railways, open spaces or new housing have all taken their toll and nibbled away at fortifications from an earlier age. Often Vauban's main town *enceinte* has been swept away, leaving only his citadel, as at Boulogne, Perpignan, or Sedan; but equally often the fortifications have been destroyed in their totality, apart perhaps from an ornamental gatehouse or some other small feature. Examples are Alt-Brisach, Cambrai, Embrun, Grenoble, Landrecies, and Luxembourg. In some cases everything built in the Middle Ages has been lovingly preserved while anything built afterwards, even by Vauban, has been systematically demolished. In other cases the modern tourist may perhaps find just a token stretch of curtain wall remaining, with maybe a forlorn bastion flanking one end while a municipal tennis court or a car park blocks off the other. Furnes, Bouchain, and Weissembourg fall into this category, and at

Sélestat the bastion itself has been further humiliated by being converted into an item of installation art.

In the many cases where Vauban's work no longer exists, our best means of imagining it is often to be found in the two museums of *plans reliefs*: one in Lille, as mentioned above, and the much bigger one in the attic of Les Invalides in Paris. Alas, less than half of the latter museum's holdings have so far been put back on show following the bureaucratic upheavals of 1986; but as the years go by an ever increasing proportion will be displayed. It is also worth remembering that in 1808 Vauban's heart was translated to this building, to repose alongside the mortal remains of a selected band of far less worthy French and Corsican warriors.



LEFT Remains of the earthwork rampart leading eastwards from Fort Nieulay to the city centre in Calais. This earthwork was designed to protect the inland anchorage for shipping – which no longer exists – against attack from the landward side (the 17th century layout of the anchorage and fieldwork is shown on the *plan relief* on page 51.). Note that today there are far too few accessible fieldworks remaining from Vauban's era, as compared to his many accessible fortresses, although they were often of huge strategic importance (e.g. the 'lines' in Flanders or around Wissembourg during the War of the Spanish Succession). (Paddy Griffith)



LEFT Installation art covering the sole surviving bastion at Sélestat – which used to be a major fortress commanding the middle reaches of the River Ill, behind the west bank of the Rhine. Alas, how far it seems to have wandered from its original purpose! (Jeff Fletcher)

Bibliography and further reading

Blomfield, R, *Sebastien le Prestre de Vauban*, 1633–1707 (Methuen, London, 1938). A serious analysis of Vauban's achievement by an architect – and in English too.

Duffy, Christopher J, *Fire and Stone* (David & Charles, Newton Abbot, 1975). An admirably lucid presentation of all the essentials of bastioned fortification.

Duffy, Christopher J, *Siege Warfare*, 2 vols (RKP, London, 1979 and 1985). Vol. I: *The fortress in the early modern world 1494–1660*. Vol. II: *The fortress in the age of Vauban and Frederick the Great, 1660–1789*. Excellent and amazingly well informed account not only of the fortress builders worldwide, including Vauban, but also of the role of fortresses in general strategy.

Fort and *Casemate*, the journals of the Fortress Study Group.

Haettel, J-P, *Vauban aux frontières de l'Est* (Le Verger, Strasbourg, 1997). A short modern account centred on Vauban's waterworks and fortified sluices in Alsace.

IGN map No. 907: *France, forts et citadels, musées militaires*. A good guide to the Vauban fortifications that are still in a fair condition for viewing today.

Les Oisivetés de l'Association Vauban, published by the Musée des Plans Reliefs, Paris.

Renson, Daniel, ed., 'Vauban, Ingénieur du Roi-Soleil ... et auteur des 'Oisivetés', in *Les Grands Personnages de l'Histoire*, No.1, May 2004. A comprehensive collection of short modern notes on Vauban's life and works, with splendid colour plates from the *Traité de l'attaque des places*.

Vauban, S le P de, translated and edited by Rothrock, G A, *A manual of siegecraft and fortification* (University of Michigan Press, Ann Arbor, 1968). Mostly about the attack rather than the defence of places, but a rare presentation in English of the Marshal's actual words.

Virol, Michèle, *Vauban, de la gloire du roi au service de l'état* (Collection Epoques, Presses Universitaires de France/Champ Vallon, Seyssel, Ain, 2003). A modern general biography, albeit rather ethereal and 'literary', which includes a year-by-year analysis of Vauban's movements.

Warmoes, Isabelle, *Musée des Plans-Reliefs* (English edition, Editions du patrimoine, Paris, 1999). An exemplary and beautifully illustrated summary of this essential collection.

Wenzler, Claude, *Architecture du bastion, l'art de Vauban* (Editions Ouest-France, Rennes, 2000). Excellent short introduction to the subject.

Other valuable works not used by the author

Augoyat, A M, *Notice historique sur les fortifications, les ingénieurs et le corps de génie de France* (2nd edition, 3 vols, Paris, 1860–64).

Blanchard, Anne, *Vauban* (Fayard, Paris, 1996).

Hebbert, F J, and Rothrock, G A, *Soldier of France, Sebastien le Prestre de Vauban* (Peter Lang, 1989).

Lazard, *Vauban* (Paris, 1934). The fullest biography.

Pujo, Bernard, *Vauban* (Albin Michel, Paris, 1991).

Rochas d'Aiglun, A, *Vauban, sa famille et ses écrits* (Paris 1910, reprinted 1972). The edited works of Vauban.

Glossary

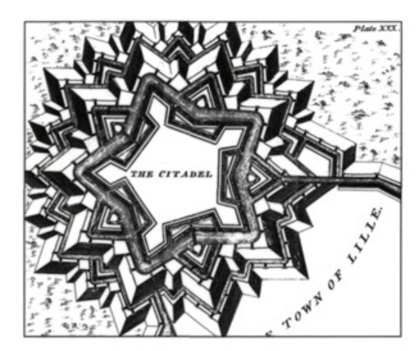
Banquette An infantry firestep.
Bastion Four-sided work protruding from a curtain wall to provide flanking fire.
Caponnière An elongated casemate built across a ditch to give flanking fire.
Casemate A vaulted masonry shelter for men, guns, or stores, usually dug into the rear of a fortress rampart. Sometimes includes firing apertures to the exterior of the rampart.
Cavalier A redoubt on top of a bastion to obstruct grazing fire and provide a more elevated gun position.
Chemin Couvert 'Covered way' between the moat and the glacis.
Chemin des Rondes Protected infantry walkway at the top of the masonry facing of the scarp.
Contregarde 'Counterguard', an arrow-shaped detached work to protect a bastion.
Contrescarpe The 'counterscarp', or outer wall of the moat, facing inwards towards the scarp and carrying the covered way.
Courtine The 'curtain' wall (or rampart) between two bastions.
Cuvette Small ditch or trench dug in the middle of the main moat.
Demi-Lune 'Half moon' triangular detached work placed in the main ditch. Usually synonymous with a 'ravelin'.
Echanguette See *Guérite*.
Enceinte The total main outer wall of a fortress, but often used to distinguish the wall around a civilian town from its all-military citadel (or final stronghold).
Epaule See *Orillon*.
Fausse-braye A minor parapet and musketry position set at the base of the main rampart, for defence of the main moat.
Fraises Stakes or 'storm poles' fixed horizontally outwards from parapets to deter escalades.
Glacis The gentle slope upwards from the level ground outside the fortress to the crest of the covered way.
Gorge The rear entrance to a bastion, which will be wide if the frontal angle of the bastion is wide (or obtuse) or narrow if the angle is acute.
Guérite A one-man stone or timber sentry box set in front of a rampart.
Lunette A small ravelin, often in an advanced position on the glacis.
Merlon Solid masonry or brick parapets into which artillery embrasures might be cut.
Orillon Recess for artillery set back behind the flank of a bastion, where it meets the courtine, and hence covered from fire from the front.
Ouvrage à Cornes 'Hornwork': a detached work made of two half bastions, and possibly reinforced (or 'crowned') by a crownwork.
Palisades Fence of posts with 3in. gaps between each. Used, for example, on the covered way or in a dry moat.
Place Word use for the totality of a fort or fortress. Thus, instead of saying 'Vauban built a fortress' on the Lys canal, we might say he 'built a place' there.
Place d'Armes Defended areas on the covered way where troops could gather for sallies, counter-attacks, etc.
Plan Relief Literally a 'relief map': the name applied to the detailed 1:600-scale architectural models that began to be collected by Louis XIV in the 1660s. The collection grew until 1870 and parts of it may be inspected today in Les Invalides in Paris, and in the Musée des Beaux Arts in Lille. Other individual models may also be found in particular fortresses, e.g. at Belfort and Neuf Brisach.
Pré Carré Literally a 'square field', hence a 'ring-fenced estate', hence a 'sphere of influence', or an 'area' (whether physical or conceptual) in which the power of only one particular authority holds sway. In Vauban's terms he saw the French 'hexagon' (which is, confusingly, not a square) as a zone in which the king's sovereignty was undisputed, and in which no enemy fortresses were allowed. This ideal was not in fact achieved during his lifetime, but he did much to push it forward.
Ravelin English for a *Demi-Lune* (q.v.).
Reduit A 'redoubt', or small, fully enclosed work (normally square) which might be placed on a larger work or on the covered way, or might stand independently.
Scarpe The 'scarp', 'rampart', or main wall facing outwards and carrying the main artillery positions.
Tenaille A small, low work placed before a curtain wall between two bastions.
Terre-plein Literally the 'flat ground' on top of the rampart where the defensive artillery could be deployed behind a parapet.
Trace The plan-view of a fortification, i.e. the outline when seen from above.
Traverse Earth mound set at right angles to the line of a parapet or covered way, to limit the damage caused by enfilade fire. May also be used as an infantry position or retrenchment to block an enemy's advance sideways along the parapet.

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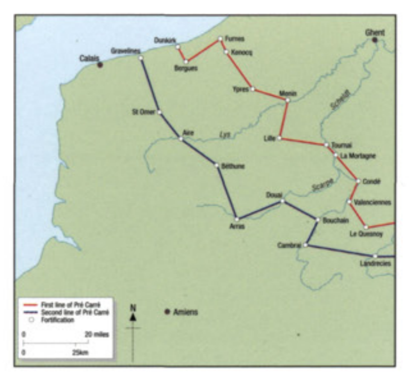
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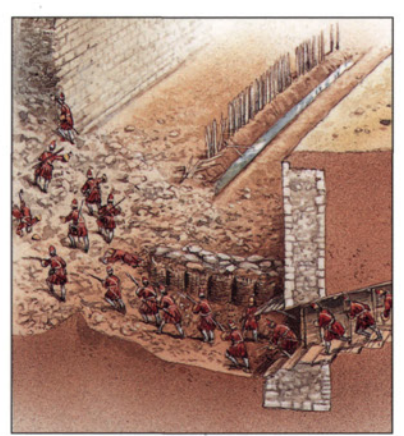
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